Preliminary Design Report

Bucknam Road Bridge #5830
over
Interstate 295

Falmouth, Maine

STP-02172(000)
WIN 21720.00

Maine Department of Transportation
Bridge Program

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BACKGROUND INFORMATION

TOWN	Falmouth	**WIN**	21720.00	**BRIDGE NO.**	5830
BRIDGE	Bucknam Road Bridge			**STATE ROUTE**	N/A

FUNDING: State

PROGRAM SCOPE: Bridge Replacement

PROGRAM DESCRIPTION: Bridge replacement of Bucknam Road Bridge (#5830) over Interstate 295, located 0.3 miles east of Route 9 and 0.3 miles west of Route 1.

PROJECT BACKGROUND: This bridge was constructed in 1960 with minor rehabilitation work completed in 1991. The deck is currently in fair condition and in need of a replacement. The remainder of the superstructure and the substructure are in satisfactory condition.

		JURISDICTION	State Aid	**NHS**	No
FUNCTIONAL CLASSIFICATION			Minor Arterial	**CORRIDOR PRIORITY**	3
		URBAN/RURAL	Urban	**FHWA SUFFICIENCY RATING**	72.3
		LOAD POSTING	Open, no restriction	**POSTED SPEED**	35 mph
TRAFFIC:	2016	**AADT**	14,010	**ACCIDENT DATA, CRF**	0.23
	2036	**AADT**	16,810	**DHV**	1,750

EXISTING BRIDGE

YEAR BUILT 1960 **SPAN LENGTHS** 43.5'-63.5'-63.5'-54' **CURB TO CURB WIDTH** 26'

TYPE OF SUPERSTRUCTURE: Four-span continuous structure with painted steel beams, noncomposite cast-in-place deck, with bituminous wearing surface. Both guardrails consist of 1' wide concrete parapets topped by aluminum alloy guardrail.

GENERAL CONDITION: Steel beams are in generally satisfactory condition (6) with areas of paint loss and isolated heavy scaling at the beam ends. Speckle and spot rust is present on the bottom flanges over the travel lanes. Girder 1 and 4 of span 2 over the SB lanes exhibit apparent previous repair from vehicle collision. The concrete deck is in fair condition (5) with areas of delamination with several regions that have been chipped out. The wearing surface has longitudinal cracking at the center of the westbound lane. The bridge rail has accident damage and fascia spalls. Curbs have section loss with exposed rebar at both ends of the bridge.

TYPE OF SUBSTRUCTURE: Concrete stub abutments on H-piles. Concrete 3 column piers on H-piles.

GENERAL CONDITION: The substructure is in satisfactory condition (6). The abutments and wings have scattered minor to moderate cracking with rust staining on the abutments. The piers have isolated minor cracking with rust staining where the deck drains spray onto the pier cap.

LOAD RATINGS:	**OPERATING**	**INVENTORY**
HL-93 Truck	34.5 Tons	26.6 Tons
Rating Factor	0.96	0.74

	LEGAL LOADS
Controlling Configuration: 3	43.6 Tons
Rating Factor	0.99
Controlling Member:	Exterior stringer for Negative Moment

STRUCTURALLY DEFICIENT No **FUNCTIONALLY OBSOLETE** Yes

MAINTENANCE PROBLEMS: Maintenance issues include deterioration of the bituminous wearing surface, cracking, spalling, and vehicular damage of concrete bridge rail and curb, cracking and exposed rebar on the underside of the deck, and cracking and deterioration of pier columns and abutment backwalls.

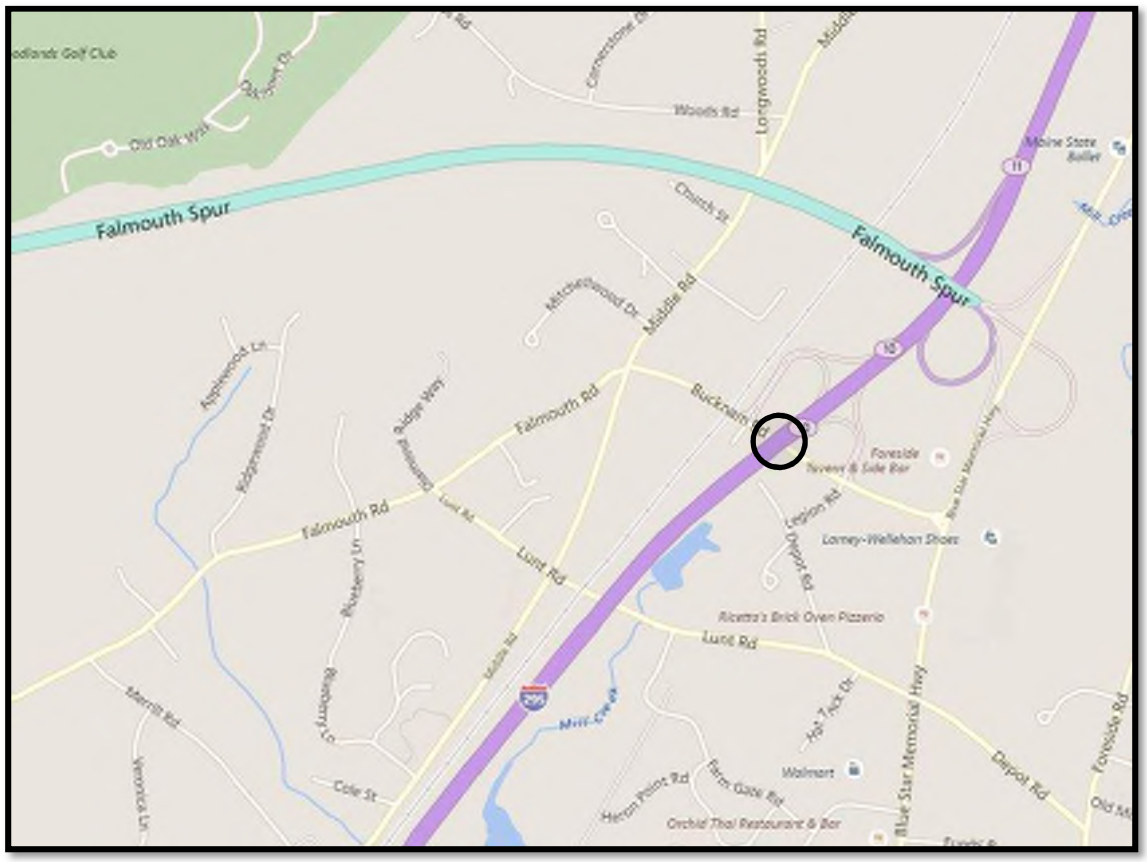
MAINTENANCE WORK: Evidence of patching on substructure components including backwalls and piers. Evidence of previous structural steel repair to girders 1 & 4, span 2, for vehicle collision damage.

PREVIOUS STRUCTURE: Original structure

OTHER COMMENTS: None

LOCATION MAP

Falmouth, Bucknam Road Bridge #5830, WIN 21720.00
Bucknam Road over Interstate 295



Latitude: 43° 43' 39.83" N, Longitude: 70° 14' 13.18" W

BRIDGE RECOMMENDATION FORM

TOWN	Falmouth	**BRIDGE**	Bucknam Road Bridge	**BRIDGE NO.**	5830
DESIGNED BY	WSP	**DATE**	9/12/2018	**WIN**	21720.00
APPROVED BY	_____	**DATE**	_____	**STATE ROUTE**	N/A
APPROVED BY	_____	**DATE**	_____		

PROJECT: Complete bridge replacement. Two-span bridge with integral abutments on H-piles. New bridge will be widened to accommodate three lanes of traffic, two 5' shoulders and one sidewalk. The approach work for this project will tie into the proposed Bucknam Road/I-295 NB/Legion Road intersection reconfiguration project. Approximately 550' of approach work to widen the road is anticipated to be included as part of this project.

ALIGNMENT DESCRIPTION: The proposed horizontal alignment closely matches the existing centerline of Bucknam Road. The alignment across the bridge was developed to tie into the proposed alignment developed as part of the Bucknam Road/I-295 NB/Legion Road intersection improvements project (WIN22672). The alignment across the bridge is tangent and ties into the Bucknam Ramp project's proposed alignment at Sta. 99+28.74. From the west, the proposed vertical alignment consists of a 2.85% grade which matches the existing grade at Sta. 95+69.23, then transitions to a sag vertical curve from Sta. 95+84.23 to Sta. 97+24.23 with an exiting grade of 5.5%. The proposed bridge is on a vertical crest curve beginning at Sta. 97+24.23, with incoming grade of 5.5%, and ending at Sta. 99+84.23, with exiting grade of -1.12%,. The -1.12% grade continues to a crest vertical curve beginning at Sta. 101+55.23 and ending at Sta. 102+55.23 with an exiting grade of -2.51%. The -2.51% grade matches existing grade at Sta. 103+57.82.

APPROACH SECTION: Three 11' lanes, two 5'-0" shoulders, and one 6'-0" sidewalk to the south. To the west of the bridge, the approach shoulders taper to match the existing 2'+/- shoulders. To the east of the bridge, the 5'-0" shoulders and 6'-0" sidewalk continue east to tie into the proposed Bucknam Road/I-295 NB/Legion Road intersection improvements.

SPANS	118'-6" – 118'-6"	**SKEW**	18°49' ahead on left
LOADING	HL-93 Modified for Strength I	**DESIGN SPEED**	35 mph

SUPERSTRUCTURE: Proposed superstructure will consist of a 9" reinforced concrete bare deck with integral wearing surface on six (6) welded steel plate girders. The superstructure will be 2-span continuous utilizing welded steel plate girders. The steel superstructure will be metalized. Four bar steel traffic barrier will be installed on the sidewalk and three bar steel traffic barrier installed on the brush curb. The out-to-out bridge width will be 52'-4".

ABUTMENTS: Cast-in-place reinforced concrete integral abutments with in-line wingwalls supported on H-piles. Maximum 2:1 slopes will be utilized for grading in front of and adjacent to the proposed abutments. The sloped area under the bridge will be treated with Crushed Stone Slope Protection. Abutments are skewed at 18 degrees 49 minutes ahead on left to align with the I-295 alignment below.

PIERS: Cast-in-place reinforced concrete wall pier. The ends of the wall pier will be constructed with a negative batter and each face will receive a recessed panel with formliner finish, similar to the geometry and finishes as detailed on the Lunt Road Bridge Replacement project (WIN21723). The wall pier will be supported by H-piles consisting of existing pier H-piles to be re-used and new H-Piles to be installed. The pier is skewed at 18 degrees 49 minutes ahead on left to align with the I-295 alignment.

AVAILABLE SOILS INFORMATION: Geotechnical investigation was not scoped as part of the preliminary design phase. Subsurface exploration and geotechnical evaluation will be performed during final design. The boring logs for the existing Bucknam Road bridge, dated March 1958, can be found in the existing plans included as Appendix D.

ADDITIONAL DESIGN FEATURES: The Bucknam Road Bridge Replacement (WIN21720.00) will coordinate with the Bucknam Road/I-295 NB/Legion Road intersection improvements project (WIN22672.00) to ensure a consistent horizontal alignment, vertical profile, roadway approach section, and limits of work. The two projects are proposed to be advertised together for construction.

MAINTENANCE OF TRAFFIC: Maintain two-way traffic on a minimum 24' curb-to-curb, two-lane temporary bridge located south of the existing bridge. For additional information on the temporary bridge, please refer to the Summary of Preliminary Design, Maintenance of Traffic Section.

CONSTRUCTION SCHEDULE: One construction season including landscaping.

ADVERTISING DATE: July 2019

		Program Amount	Available Funding	Estimated Project Cost	Shortfall/ Surplus
Preliminary Engineering		$200,000	$200,000	$200,000	*$0*
Right-of-Way		$5,000	$5,000	$5,000	*$0*
Construction [	**Structure**	$3,800,000	$3,800,000	$5,280,000	*-$1,480,000*
	Approaches			$220,000	*-$220,000*
Construction Engineering		$200,000	$200,000	$200,000	*$0*
Total		**$4,205,000**	**$4,205,000**	**$5,905,000**	**-$1,700,000**

ADDITIONAL BORINGS REQUIRED? Yes

ADDITIONAL GEOTECHNICAL EVALUATIONS REQUIRED? Yes

APPROVED DESIGN EXCEPTIONS: None

COMMENTS BY ENGINEER OF DESIGN:

SUMMARY OF EXPECTED IMPACTS

RIGHT OF WAY Number of: Property Owners 0
Buildings to Be Taken 0

Type of Acquisitions: ☐ Fee Simple ☐ Easement
☒ Temporary Rights ☐ Temporary Road

UTILITIES: Overhead utilities along south fascia.

COAST GUARD PERMIT NEEDED? No **FAA PERMIT NEEDED?** No

ENVIRONMENTAL COORDINATION

Team Member: Kristen Chamberlain

NEPA/STIP	N/A- No Federal Funds
Section 106	N/A- No Federal Funds
Section 4(f)	N/A-No USDOT Funds
Federal Endangered Species	No Federal Nexus
State Endangered Species	Least bitterns in project area. Coordinated with IF&W; no further action required.
Essential Fish Habitat	No in-water work.
Fish Passage	N/A
In-Stream Window	N/A
Hazardous Material	No hazardous waste review required.
Dredge Material	N/A
Stormwater/MS4	N/A
DEP/LUPC	No jurisdiction
ACOE	No jurisdiction
Mitigation	N/A
Other	

Avoidance & Minimization: The proposed bridge and approach work are located within existing MaineDOT ROW. Temporary approaches for the temporary bridge will be constructed south of the existing structure. Temporary retaining walls (i.e. soldier pile & lagging) may be required for sections of the temporary approach work in order to keep temporary embankments within existing MaineDOT ROW.

SUMMARY OF PRELIMINARY DESIGN

1. BACKGROUND:

The Bucknam Road Bridge (#5830) between Route 9 and Route 1 spans over both barrels of Interstate 295 in Falmouth, Maine. The existing bridge consists of 4 continuous spans (43.5'-63.5'-63.5'-54') for a total span length of 224.5'. The bridge was built in 1960 and consists of continuous steel stringers with a 7" thick noncomposite bridge deck with bituminous overlay. The abutments are composed of reinforced concrete founded on H-piles, and all three piers are 3-column bents with concrete caps supported on H-piles. The original bridge cross section was 26' curb to curb, with a 2'-6" concrete curbed safety walk on each side. Both bridge railings consist of a 1' wide concrete parapet with extruded aluminum alloy railing, for a total out to out width of 33'-0".

Rehabilitative work was completed on the structure in 1991. This work included replacing the bituminous wearing surface and membrane waterproofing, cleaning and painting the existing structural steel and bearings, replacing the existing joints with armored compression seals, rehabilitating existing concrete as needed, repairing damaged steel beams and repairing cracked concrete bearing pads.

The bridge was originally scoped for a bridge deck replacement in the Department's 2016-2019 Statewide Transportation Improvement Program-STIP with a total budget of $2.0 million for PE, ROW and Con/CE. However, the traffic analysis revealed the need for an additional lane on the bridge. As such, the scope of the preliminary design was updated to no longer consider a deck replacement but to consider bridge widening and full bridge replacement alternatives. The updated total budget for the revised scope of work is $4.205 million for PE, ROW, and Con/CE.

2. EXISTING CONDITIONS:

Per the 2016 inspection report, provided by MaineDOT, the existing steel beams are generally in satisfactory condition (6) with minor to moderate paint loss and moderate isolated heavy scaling at the beam ends. The north fascia girder of the SB lane has collision damage gouges with very minor sweep. The structural steel system has an LRFR rating of 0.74 and a governing statutory rating of 0.99. Girder 1 & 4 of span 2 show previous steel repairs from apparent vehicle collision damage. State records indicate the minimum clearance of the structure over I-295 at 14'-4".

As indicated in the 2016 inspection report, the concrete deck is in fair condition (5) with isolated areas of delamination and spalling. Aluminum two bar rail on top of the concrete parapet exhibits signs of vehicular damage with concrete spalls. The curbs have section loss with exposed rebar at both ends of the bridge.

The abutments and wingwalls have scattered minor to moderate cracking with rust staining on the abutments. The piers have isolated minor cracking with rust staining where the deck drains spray onto the pier caps. Overall, pier columns are in good condition. Slope protection is in

overall good condition; however, areas directly under the deck drains have moderate damage.

3. UTILITIES

There are aerial wires approximately 8-10 feet off the south fascia that span over I-295. Aerial utilities onsite include:

- 3-phase power cables (owned by Central Maine Power Company)
- Communication Cables (owned by Consolidated Communications)

There are existing conduits attached to the underside of the north deck overhang to power lights attached to the pier caps at piers 1 and 3. The junction boxes located at the abutments are in disrepair, it is unclear if the lights provided at the piers are currently functioning.

The existing aerial facilities south of the bridge will likely require permanent relocation for design alternatives that consider structure widening/replacement to the south. Further utility coordination is required during final design to coordinate construction activities.

4. GEOMETRIC ALIGNMENT

The Bucknam Road profile consists of a vertical crest curve across the bridge. The existing minimum vertical clearance under the bridge over I-295 SB is 14’-4” at the right shoulder. The proposed rehabilitation/replacement work considers improving the vertical clearance to a minimum of 16’-0”. In order to achieve a minimum of 1’-8” improvement in clearance, a combination of minimizing the superstructure depth and shifting the Bucknam Road profile vertically over the bridge will likely be necessary, depending on the design alternative selected. As discussed at the project kick-off meeting, any profile adjustments will tie back in prior to the existing at-grade rail crossing west of the bridge to not impact the at-grade railroad crossing. On the east side of the bridge, profile modifications will tie back into and match the existing profile beyond the approaches as quickly as practical.

The Bucknam Road horizontal alignment is tangent over the bridge. Depending on the alternative for rehabilitation/replacement, the roadway alignment may be required to shift over the bridge. Beyond the limits of the bridge approaches, any shift in horizontal alignment would be transitioned to tie back into the existing alignment as quickly as practical while complying with standard geometric roadway standards as to limit the extent of roadway approach work.

5. EXISTING BRIDGE LOAD RATING

As part of the preliminary design effort, a load rating of the existing bridge was performed in November 2016. The existing stringers and deck are non-composite. The existing rating of the non-composite stringers yielded an inventory rating of 0.74 for the HL-93 design vehicle and a governing statutory rating factor of 0.99 for MaineDOT Configuration 3. MaineDOT’s Engineering Instruction S1 provides guidelines for minimum Customer Service Levels to be targeted during bridge rehabilitations in terms of minimum inventory rating factors for different corridor priorities.

Bucknam Road is classified as corridor priority (CP) 3. Based on the criteria for rehabilitated bridges provided in Engineering Instruction S1, a rehabilitated bridge with CP 3 must have a rating factor greater than or equal to 1.0 for Maine's Legal Loads.

The governing rating location for both interior and exterior beams is for moment in the negative flexure region over the pier at the cover plate termination. Long unbraced lengths of the bottom flanges in these regions (bottom flange is the compression flange in negative flexure regions) govern the load carrying capacity with lateral torsional buckling being the controlling design criteria. Preliminary analysis of the existing stringers, considering proposed loadings, indicate that providing additional brace points along the bottom flange will help to reduce the unbraced length of the compression flange in these critical areas, resulting in increased load carrying capacity for the existing stringers. The addition of new braces to the bottom flange would not be a complex retrofit and would not be a significant additional cost to other rehabilitation efforts.

At a minimum, the design alternatives consider a deck replacement. The new deck will be made composite with the steel superstructure by installing shear connectors. Carrying the shear connectors through the negative flexure region of the continuous stringers will allow for negative moment steel in the deck to be considered in the load carrying capacity of the bridge. Carrying shear studs through the negative moment region of the stringers to provide composite behavior throughout the stringer would not be a complex retrofit and would not be a significant additional cost to the overall rehabilitation efforts.

The existing 2016 Load Rating Report can be found in Appendix E.

6. TRAFFIC

The bridge carries Bucknam Road over I-295 NB & SB with 2014 traffic volumes of 14,010 AADT with 3% trucks. The AADT volumes on I-295 are 27,010 and 25,680 for northbound and southbound respectively. Additional traffic data is included in Appendix G.

Accident data was reviewed and there is not a significant amount of crashes in the project area. The accident data is included in Appendix G.

During the development of the preliminary design for the Bucknam Road bridge, final design was completed for the reconfiguration of the I-295 NB ramp/Bucknam Road/Legion Road intersection. This intersection project is a MaineDOT Locally Administered Project (LAP) which adds permanent signals to the intersection and a dedicated left turn lane for westbound traffic onto the I-295 NB ramp. MaineDOT performed a traffic analysis of the proposed intersection improvements and it was determined that a third lane was necessary between the two ramp intersections to serve as turning lane storage.

7. COMMUNITY OUTREACH

A preliminary public meeting with representatives and residents from the Town of Falmouth was conducted on October 20, 2016 to provide initial information about the proposed project and to elicit questions, comments, and concerns from the public to be considered when analyzing design alternatives. From this meeting, representatives from the Town of Falmouth provided background information on the town's Bicycle & Pedestrian Plan as it pertains to

Bucknam Road as well as its efforts throughout the town to make travel more bicycle and pedestrian accessible.

The Town of Falmouth has identified Bucknam Road as an existing pedestrian route and future bicycle route. The town defines a bicycle route as a road which has a paved shoulder and is suitable for bicycling. The 2016 Falmouth Bicycle and Pedestrian Plan can be found in Appendix H.

With consideration given to MaineDOT's *Complete Streets Policy*, the rehabilitation of the Bucknam Road bridge provides the opportunity to improve safety for motorists, bicyclists and pedestrians using the bridge. The existing bridge does not provide sidewalks and has narrow shoulders that cannot be safely used by bicyclists. The Town of Falmouth has demonstrated its commitment to increasing pedestrian and bicycle mobility throughout the town by playing an active role in recently completing and currently programmed transportation improvement projects to ensure that bicycle and pedestrian accessibility is addressed whenever feasible. In accordance with the 'Project Relevance and Feasibility' section of the Complete Streets Policy and in consideration of efforts being made locally in the Town of Falmouth to provide better pedestrian and bicycle connectivity, improvements to pedestrian and bicycle facilities were added to the scope of this project to be evaluated as the alternatives for consideration.

8. PRELIMINARY GEOTECHNICAL EVALUATION & RECOMMENDATIONS

Preliminary design did not include new geotechnical investigations.

Per the existing bridge plans, the existing abutments and piers are supported on H-piles. A copy of the existing boring logs can be found in the existing plans in Appendix D.

Bridge widening/replacement alternatives will require additional geotechnical investigations as part of final design.

9. RIGHT OF WAY

Right-of-way lines provided by MaineDOT are shown on the General Plan included in Appendix A. Permanent property acquisitions are not anticipated for the alternatives under consideration.

10. PROJECT SCHEDULE

The preliminary project schedule for the recommended alternative calls for project advertisement in July 2019. Construction would begin in fall 2019 and be completed by fall 2020.

11. PURPOSE AND NEED

The primary goals for this project, at a minimum, are to address structural deficiencies throughout the existing bridge, address non-vehicular mobility over the bridge, improve the structure capacity to address current and future traffic demands, and improve vertical clearance under the bridge over I-295.

The most recent bridge inspection report, conducted 6/16/2016, indicates the bridge deck is in fair condition with the superstructure and substructure both in satisfactory condition with

localized deterioration. See section 2, *Existing Conditions*, for additional discussion pertaining to the bridge condition. An LRFR bridge rating for the existing structure was completed as part of the preliminary design. The existing load rating reveals rating factors of 0.74 for the HL-93 design truck and 0.99 for the governing MaineDOT Legal Load Configuration. See section 5, *Existing Bridge Load Rating*, for additional discussion pertaining to the structural deficiencies noted in the bridge rating.

The existing bridge does not provide a sidewalk and has substandard 2'+/- shoulders. Traffic analysis and the re-design of the I-295 NB/Bucknam Road/Legion Road intersection east of the bridge require that a third lane be added to the Bucknam Road bridge to facilitate through traffic and turning movements for ramp traffic. The existing under clearance over I-295 is 14'-4" with a required minimum equal to 16'-0". The existing bridge exhibits signs of prior vehicle collision damage as portions of girders 1 and 4 over I-295 SB appear to have been previously replaced.

12. BUCKNAM ROAD/I-295 NB/LEGION ROAD INTERSECTION COORDINATION

The Bucknam Road bridge is located immediately east of the existing I-295 SB ramp/Bucknam Road intersection and roughly 500' west of the I-295 NB ramp/Bucknam Road/Legion Road intersection. A MaineDOT Locally Administered Project (LAP) to modify and signalize the I-295 NB ramp/Bucknam Road/Legion Road intersection has been designed and is currently awaiting construction. The redesigned intersection will utilize a dedicated left-turn lane for eastbound traffic turning on to I-295 NB. Based on traffic analysis performed by MaineDOT a third lane needs to be provided on the Bucknam bridge to facilitate proper performance for throughtraffic and turning traffic at both the existing signalized intersection west of the bridge and at the redesigned intersection east of the bridge.

The proposed horizontal alignment for the widening and replacement design alternatives was developed with consideration of how the proposed bridge work would tie into the proposed intersection redesign. The Bucknam Road bridge rehabilitation/replacement is proposed to be advertised for construction with the Bucknam Road/I-295 NB/Legion Road intersection project. Coordination with the designer for the intersection project was initiated during preliminary design and will continue throughout final design.

13. SUMMARY OF DESIGN ALTERNATIVES

This project was initially scoped as a deck replacement; however, based on the above objectives, the project scope was modified to consider a widening of the existing bridge and a full bridge replacement. The minimum requirements considered for a widening or full replacement include three 11' travel lanes, two 5' minimum shoulders and one 6' minimum sidewalk.

To focus the evaluation for construction approach and maintenance of traffic, alternatives for a widening of the existing structure and a full replacement were developed utilizing the same construction and maintenance of traffic constraints. A summary of the initial widening and replacement alternatives developed are detailed below:

- WIDENING: The widening alternative considers constructing substructure extensions to the north of the existing bridge to support the widened superstructure. This alternative

includes the following work items: abutment and pier extensions, new approach slabs, replacement of all existing stringers (5 total) with eight (8) new, metalized stringers, new bearings at all supports and a new concrete deck with sidewalk, brush curb and steel bridge railing.

The abutment and pier extensions are proposed to be completed without impact to traffic carried by the Bucknam Road bridge. Once the substructure widening is complete, the northern portion of the existing superstructure will be demolished and the new, widened northern superstructure section will be constructed in stages. Two lanes of traffic will be maintained on the existing superstructure while the new, northern portion is constructed. Both lanes of traffic will then be relocated to the newly constructed northern portion while the remainder of the existing superstructure is demolished and replaced.

- REPLACEMENT: The replacement alternative considers replacing the existing 4-span bridge with a 2-span integral (or semi-integral) bridge. This alternative considers the complete replacement of all superstructure and substructure elements. Replacement alternatives with staged construction considered widening to the north or south. Constructing the first phase to the north or south was found to have similar construction costs.

  The portion of the new abutments, center pier and superstructure constructed during phase 1 are proposed to be completed without impact to traffic carried by the Bucknam Road bridge. Once the phase 1 substructure and superstructure is completed, both lanes of traffic will be relocated to the newly constructed portion while the existing superstructure is demolished and replaced.

Both design alternatives satisfy the Purpose & Need by improving the structural performance of the bridge, improving traffic flow by providing adequate width for three lanes of traffic, minimum 5’ shoulders, a 6’ minimum sidewalk, and improving the vertical clearance of I-295 by modifying the profile over the structure and/or optimizing the superstructure depth. Both design alternatives consider conventional construction methods with staged construction while maintaining two lanes of traffic on Bucknam Road throughout construction. As the construction related impacts and maintenance of traffic schemes would be similar for both alternatives, the two concepts were evaluated considering both upfront costs and life-cycle costs.

The estimated construction costs for each design alternative, considering the above construction approaches, are listed below in Table 1:

Widening – Staged/ Conventional (2 Lanes)	**Full Replacement – Staged/ Conventional (2 Lanes)**
$4.67 Million	$5.16 Million

Table 1: Upfront Cost Comparison Widening vs. Full Replacement

To assist in evaluating the two design alternatives, anticipated capital expenditures for maintenance, repairs and replacements required throughout a 75 year design life were developed. See Table 2 below that summarizes the anticipated capital expenditures (in 2017 dollars) and frequency.

Activity	Widening			Full Replacement		
	Frequency (Years)	Const. Cost (in 2018 $)	Total (in 2018 $)	Frequency (Years)	Const. Cost (in 2018 $)	Total (in 2018 $)
Bridge Widening/Full Bridge Replacement (Conventional/Staged)		$4,680,000	$4,680,000		$5,150,000	$5,150,000
Bridge Inspection (bi-annual)	2	$3,600	$133,200	2	$3,600	$133,200
CAPITAL IMPROVEMENTS (BRIDGE REPLACEMENT)	50	$5,150,000	$5,150,000	50	$0	$0
Repair/Replace Roadway Finish Items	15	$91,925	$367,700	15	$85,663	$342,650
Replace Deck Joints @ 25 Yrs.	25	$75,625	$75,625	25	$0	$0
Deck Replace	50	$0	$0	50	$911,780	$911,780
Replace Bearings @ 25 Yrs.	25	$166,000	$166,000	25	$70,000	$140,000
Substructure @ 10/15 Yrs.	10	$15,697	$94,182.86	15	$15,000	$60,000
Total Cost over 75 Year Period (in 2018 $)			**$10,666,708**			**$6,737,630**

Table 2: Anticipated Capital Expenditures

In addition to the upfront costs, the two alternatives were evaluated to consider future growth and widening of the I-295 corridor. The existing 4-span configuration, that would remain as part of the widening alternative, is restrictive for potential widening of I-295. Based on the existing geometry of the Bucknam Road bridge piers, a maximum travelway of approximately 51'+/- is possible between piers 1 and 2 or 2 and 3. The SB barrel is complicated by the on-ramp acceleration lane. Maintaining 12' typical lane widths, adding a third through travel lane (in addition to the on-ramp acceleration lane) would likely not allow for adequate shoulders. The replacement alternative simplifies this concern as the proposed two-span configuration would remove two existing piers and enable widening I-295 SB and NB to the west and east respectively.

Evaluation of Alternatives

Based on the lower anticipated lifetime expenditures, increased flexibility for potential I-295 widening, and an upfront cost of only $490k more than the widening, a full replacement is recommended. The project design team met January 12, 2018 to evaluate widening and replacement alternatives. The project team agreed that a full replacement was the preferred design alternative.

14. CONSTRUCTION APPROACH

With the recommendation that a full bridge replacement be pursued, potential construction approaches were developed and evaluated to assist the project team in determining the preferred approach to pursue in final design.

All full replacement construction approaches evaluated consider the same proposed new bridge characteristics:

- The proposed bridge cross-section will be comprised of three 11' travel lanes, two 5' shoulders, one 6' sidewalk and steel bridge rail.
- 2-span continuous steel (two 118'-6" spans, total length centerline of bearing to centerline of bearing = 237'-0").
    - Span lengths have been equalized as is recommended for multi-span integral bridges. New abutment piles on the east abutment will be installed between the front two rows of piles in the existing east abutment. New abutment piles on the west abutment will be installed behind the last piles in the west abutment wingwalls.
- The deck will be composite with the steel girders. The deck will have a 1" thick integral wearing surface, an 8" depth for structural design for a total deck thickness equal to 9".

- The proposed superstructure will be comprised of six (6) welded steel plate girders spaced at 9'-4" with an out-to-out structure width equal to 52'-4".
- The proposed median pier will utilize a combination of existing H-Piles and newly driven H-Piles to support pier loads.
    - The existing piles are too closely grouped under each existing column to allow new piles to be driven within the existing pile groups.
    - Removing the existing piles in their entirety is expensive and impractical due to the site constraints in the median and average pile length of 70'+/-.

The construction approaches were evaluated considering differences in construction costs, impacts to traffic on Bucknam Road and I-295, and anticipated construction duration. The construction approaches investigated are listed below:

1. <u>Full Replacement – Staged Construction/Conventional – Maintain two-way traffic</u>

    a. This approach considers constructing the new bridge in two stages, building new substructure and superstructure elements north or south of the existing bridge during phase 1 so to not impact existing Bucknam Road traffic. During phase 2, both lanes of Bucknam Road traffic would be rerouted to the newly constructed phase 1 portion while the existing bridge is demolished and the remainder of new bridge is constructed. Constructing phase 1 to the south of the existing bridge minimizes the required shift of the finished alignment from the existing centerline of roadway, compared to building phase 1 to the north.

    b. In order to minimize the final alignment shift to the extent practical and maintain two lanes of traffic during Phase 2, the proposed bridge will either require an additional girder line (7 total) or temporary deck support for the wide overhang at the phasing joint. The minimum width of deck completed during Phase 1 must be at least 26'-8" (two 11' lanes, one 1'-8" permanent steel rail, 2' temporary braced concrete barrier, and 1' deflection allowance for temporary braced concrete barrier). Utilizing a six girder configuration with 9'-4" girder spacing and a 2'-10" exterior deck overhang, the deck overhang at the phasing joint is 5'-2". This excessive overhang would require temporary deck supports along the interior girder during Phase 2. Alternatively, addition of a seventh girder line would allow four girders to be erected during Phase 1 and the deck would be adequately supported throughout staged construction. Both alternatives add additional costs (additional steel costs for extra girder line or additional costs associated with temporary deck support) compared to the basic six girder configuration.

    c. This construction approach requires that the proposed final alignment be shifted approximately 10'-6" south of the existing Bucknam Road centerline over the bridge to facilitate phased bridge construction. The proposed final alignment utilizes a 35 mph design speed and ties back in to the existing alignment prior to the existing at-grade rail crossing west of the bridge. This construction approach requires some reconfiguration of the existing intersection to the west; however, the southern shift allows the widened three-lane roadway to tie into the proposed Bucknam Road/I-295 NB/Legion Road Intersection Improvement

project to the east with minimal modifications. See Appendix J for construction phasing sketches/concepts.

2. Full Replacement – Staged Construction/Conventional – Maintain one lane through traffic

    a. This approach considers constructing the new bridge in two stages, building new substructure and superstructure elements south of the existing bridge during phase 1 so to not impact existing Bucknam Road traffic. During phase 2, one lane of Bucknam Road through-traffic would be rerouted to the newly constructed phase 1 portion and the other lane would be detoured to Lunt Road while the existing bridge is demolished and remainder of new bridge is constructed. Constructing phase 1 to the north was also evaluated; however, impacts to the Bucknam Road alignment were less severe by constructing to the south.

    b. This construction approach requires that the proposed final alignment be shifted approximately 6’ south of the existing Bucknam Road centerline over the bridge to facilitate phased bridge construction. The proposed final alignment utilizes a 35 mph design speed and ties back in to the existing alignment prior to the existing at-grade rail crossing west of the bridge. This construction approach requires some reconfiguration of the existing intersection to the west; however, the southern shift allows the widened three-lane roadway to tie into the proposed Bucknam Road/I-295 NB/Legion Road Intersection Improvement project to the east with minimal modifications. See Appendix J for construction phasing sketches/concepts.

3. Full Replacement – Temporary Bridge

    a. This approach considers erecting a temporary bridge and temporary approaches to the south of the existing bridge. Both lanes of Bucknam Road traffic would be rerouted to the temporary bridge allowing the existing bridge to be demolished and replaced. This scenario allows the final alignment to be laid out to optimally tie into both the existing intersection west of the bridge and proposed intersection improvements at the Bucknam Road/I-295 NB/Legion Road intersection to the east. Constructing the temporary bridge to the north was also evaluated; however, this would severely impact the existing SB on/off ramp intersection to the west of the Bucknam Road bridge.

    b. The proposed alignment for the temporary bridge is shifted approximately 60’ south of the existing Bucknam Road centerline. This shift allows for 10’+/- to be maintained between the proposed replacement bridge’s south fascia and the north fascia of the temporary bridge. The profile for the temporary alignment was developed to maintain a minimum 15’-6” vertical clearance over I-295 throughout construction. The proposed temporary bridge configuration utilizes two simple spans with temporary pier towers erected in the center median. Temporary stub abutments will be installed on top of temporary embankments or behind temporary retaining walls. Temporary approach embankments will be necessary to tie the temporary bridge back into Bucknam Road.

c. This construction approach may require temporary access rights for the two properties south of the bridge immediately east and west. See Appendix J for construction phasing sketches/concepts.

4. Full Replacement – ABC Slide-in

   a. This approach considers constructing the new bridge on temporary supports north of the existing bridge. While the existing Bucknam Road bridge remains in service, piles would be installed for the proposed abutments and center pier columns. Once the superstructure is completed, along with all possible substructure work, the Bucknam Road bridge would be closed and both lanes detoured. The existing bridge would be demolished, precast abutment and pier elements erected, and then the newly constructed superstructure would be slid into place. This scenario allows the final alignment to be laid out to optimally tie into both the existing intersection west of the bridge and proposed intersection improvements at the Bucknam Road/I-295 NB/Legion Road intersection to the east. See Appendix J for construction phasing sketches/concepts.

   b. To minimize the duration of the full closure on Bucknam Road, piles for the new abutments will need to be installed prior to full closure. The new piles will need to be installed behind the existing abutments from the roadway elevation during temporary night closures on Bucknam Road. Piles would be driven and then covered with steel plates during the day to allow for traffic to resume on Bucknam Road during the day. Keeping the span lengths equal, in order to install the proposed abutment piles behind the existing structure, the overall length of bridge would need to increase to 260'. See Appendix J for construction phasing sketches/concepts.

Construction Cost Comparison

The 'Two Lanes' and 'One Lane' construction approaches differ in the amount of new substructure/superstructure that is needed to be built offline from the existing bridge. Both scenarios result in the proposed final alignment being shifted to allow the new footings to be constructed without impacting the existing substructure. These independent footings are necessary to support the first phase of superstructure construction. The 'Two Lane' approach requires a larger shift in alignment, compared to the 'One Lane' option, resulting in higher construction costs for the roadway approach work to tie back into the existing alignment and to adjust the existing intersections.

Both the 'Temporary Bridge' and 'ABC Slide-in' approaches allow for the proposed bridge to be placed on an alignment that minimizes the roadway approach work and reduces impacts to the Bucknam Road/I-295 NB/Legion Road intersection improvements. However, both of these approaches require additional expenditures for either a temporary bridge to detour traffic or Slide-in technology to facilitate and expedite full bridge closure.

During preliminary design use of MaineDOT owned temporary bridge sections was investigated for possible use on this project. Based on input from MaineDOT Maintenance, in-house temporary bridge inventory could not be confirmed to be available for use as an onsite temporary detour for this project. As such, the preliminary cost estimate for the temporary

bridge alternative does not consider use of a MaineDOT owned temporary bridge and estimates costs associated with renting temporary bridge spans, temporary supports, erection/dis-assembly costs, and temporary approach work.

Construction cost estimates were developed for each construction approach. A summary of estimated construction costs is provided below in Table 3, the full Preliminary Cost Estimate can be found in Appendix K:

Full Replacement Construction Approaches – Construction Cost Estimates			
'Two Lanes'	*'One Lane'*	*'Temp. Bridge'*	*'ABC Slide-in'*
$5.16 Million	$4.89 Million	$5.50 Million	$6.35 Million

Table 3: Full Replacement – Construction Cost Estimates

Impacts to Bucknam Road and Local Traffic

The bridge carries Bucknam Road over I-295 NB & SB with 2014 traffic volumes of 14010 AADT with 3% trucks. The 2016 AADT volumes on I-295 are 27,010 and 25,680 for northbound and southbound respectively.

MaineDOT modeled anticipated traffic performance for various construction scenarios for the Bucknam Road bridge replacement. The scenarios considered include:

1. Existing Conditions
2. Existing Conditions with anticipated improvements (programmed roundabout on Middle Road and signal at Bucknam Road/I-295 NB Ramps)
3. Bucknam One-Lane WB: Through WB one-way traffic maintained with through EB detoured to Lunt Road.
4. Bucknam One-Lane EB: Through EB one-way traffic maintained with through WB detoured to Lunt Road.
5. Bucknam Road bridge Closed – with Adjustments : Bucknam Road bridge would be completely closed with surrounding signalized intersections adjusted to accommodate changes in traffic flow.

The overall performance measures include vehicles denied entry (vehicles unable to enter the one-hour simulation due to congestion in the simulation model) and queue length (95th percentile for left turns and right turns, 50th percentile for through movements). Intersection-level performance measures include volume/capacity ratio (by intersection movement) and total delay (extra travel time due to congestion, measured in vehicle hours).

As part of the traffic analysis, MaineDOT calculated user costs for each scenario. In addition to the user costs associated with delay, costs were also estimated for the additional distance traveled by detoured traffic. All three bridge closure options (WB open, EB open, and bridge closed) were compared to the existing "improved" alternative, which assumes that two programmed intersection projects are in place. Each of the closure options requires some retiming of existing traffic signals and one or more temporary traffic signals to accommodate detoured traffic. A summary of the estimated user costs is in Table 4.

Bucknam Road Bridge User Impacts and Costs					
		Improved Falmouth Network	Bucknam Rd Bridge 1 Lane Open Westbound Only	Bucknam Rd Bridge 1 Lane Open Eastbound Only	Bucknam Rd Bridge Closed Both Directions
PM Peak-Hour Travel					
	Vehicles Denied Entry	0	0	1	40
	Delay (VHT)	84	97	86	147
Delay Impacts					
	Peak-Hour Delay (VHT)	0	13	2	63
	Daily Delay (VHT)	0	48	7	235
	Daily User Costs	0	$ 633	$ 97	$ 3,068
Mileage Impacts					
	Peak-Hour VMT	6332	6693	6863	7224
	Peak-Hour Added VMT	0	361	531	892
	Daily Added VMT	0	3610	5310	8920
	Daily User Costs	0	$ 1,336	$ 1,965	$ 3,300
Combined Daily User Cost			$ 1,969	$ 2,062	$ 6,368

Table 4: Bucknam Road Summary of User Costs

This analysis highlights that the 'Full Closure' ($6,368 per day) and 'One Lane' ($2,062 per day) scenarios result in significant impacts to Bucknam Road traffic. Construction approaches that allow for continuous two-way traffic throughout the duration of construction activities will result in significantly lower user costs.

As part of the traffic simulation, MaineDOT analyzed the impacts to local Town of Falmouth intersections considering the above construction scenarios. Intersection performance was evaluated considering level of service (LOS). The analysis includes overall performance measures of 'vehicles denied entry' into the model and 'total delay' in vehicle-hours. See Table 5 for a summary of the analysis.

Falmouth - PM Peak Hour										
	Alternatives									
Intersections	Existing		Improved		Bucknam WB open only		Bucknam EB open only		Bucknam Closed adjusted	
	LOS - delay	Q>Storage	LOS - delay	Q>Storage	LOS - delay	Q>Storage	LOS - delay	Q>Storage	LOS - delay	Q>Storage
Vehicles Denied Entry	194		0		0		1		40	
Total Delay	78		84		97		86		147	
Johnson-Middle	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Johnson-US1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Long Woods-Middle	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Falmouth/Bucknam-Middle	C	EBT50 WBR95 SBL95	D-41.4	EBT50 WBR95 NBR95 SBL95	D-37.4	OK	C-26.9	NBR95	B/C-19.1	NBR95
Bucknam-SB ramps	C	WBT50 SBT50	B-16.9	EBL95 WBT50 SBT50	B-14.2	OK	A-7.1	OK	A-4.3	OK
Bucknam-NB ramps	C	SBT>>	B/C-19.5	OK	C/B-20.5	OK	C-22.0	OK	D-40.3	SBL95
Bucknam-US1	B	EBL95	C-24.5	EBL95 NBL95 SBT50	B/C-19.3	EBL95	B-17.8	EBL95	B-18.5	EBL95 WBL95 SBT50
Lunt-Falmouth	A	OK	A-7.8	OK	A-7.5	OK	B-13.8	OK	A-8.6	OK
Lunt-Middle	B/A	OK	B/A-10.6	OK	C/D-34.7	OK	B/C-19.6	WBR95	B-16.4	WBR95 **NBT95**
One-Lane Lunt (not applicable)										
Lunt-Depot	A	OK	A-2.1	OK	A-8.7	OK	B/C-19.9	OK	F-67.1	SBL95
Depot-US1	C/B	OK	C-21.2	EBR95	C-24.4	EBR50	C/B-20.6	EBR95 NBT50	F-108.6	**EBL95** EBT50 NBL95 **NBT50** SBL95 SBT50
Clearwater-US1	A	OK	A-7.4	OK	A-7.8	NBT95	A-7.9	EBR95	A/B-9.2	EBR95 **NBT95**
Hunter-US1	A-2.3	OK	A-2.3	OK	A-3.2	OK	A-2.2	OK	A-4.0	OK
Planned and Programmed Improvements										
Long Woods-Middle			in place		in place		in place		in place	
Bucknam-NB ramps			in place		in place		in place		in place	
Falmouth/Bucknam-Middle										
Bold queue indicates spillback to upstream intersection									7 denied entry at Depot-US1	
									33 denied entry at Bucknam-NB ramps	
LOS - delay based on overall intersection delay and signalized LOS scale										
Temporary treatments					install temporary signal				adjust signal timing	

Table 5: LOS Summary

The two 'One Lane' scenarios do not show significant differences for LOS compared to the 'Existing – Improved' scenario with similar 'total delay'. The 'Full Closure' scenario results in two LOS 'F' intersections with 40 'vehicles denied' with 147 'total delay' compared to 0 and 84 respectively for the 'Existing – Improved' scenarios.

Impacts to I-295

The Bucknam Road bridge spans over both northbound and southbound barrels of Interstate 295. The ability to minimize construction and traffic related impacts to I-295 to the extent practical is a critical component of this project when considering possible construction approaches.

A project team meeting for the Lunt Road Bridge Replacement (Lunt Road bridge is located approximately 1/2 mile south of Bucknam Road) was held 9/8/2017 to discuss the proposed construction work windows and potential impacts to I-295 for that project. The construction work windows discussed as part of the Lunt Road bridge project will also be implemented for the Bucknam Road bridge replacement project.

With consideration given to the high traffic volumes experienced during the daytime hours on I-295, the Contractor will not be permitted to utilize single lane closures and/or full closures on I-295 during the day between 6:00 AM and 10:00 PM. The Contractor will be allowed a limited

number of single lane closures and full closures on I-295 for the work activities specified below with the following restrictions:

- Single lane closures on I-295: 10:00 PM to 5:00 AM (Sunday through Thursday)
- Full closures on I-295: 1:00 AM to 5:00 AM (Monday through Friday)

MaineDOT's evaluation of hourly traffic volumes on I-295 indicated that full closures could begin earlier (12:00 AM) and single lane closures could start earlier and end later (9:00 PM to 7:00 AM NB and 8:00 PM to 6:00 AM SB); however, it is recommended that the more restrictive work windows listed above be utilized. During a full closure on I-295, traffic would be detoured off I-295 to Route 1 to avoid the project site. Due to the early morning time restrictions for full closure, MaineDOT's analysis indicates an approximate $1 per vehicle user cost for the detour.

All four construction approaches discussed for the full replacement alternative will require temporary single lane and full closures of I-295 to safely complete certain work activities. For example, all scenarios will require temporary full closures on I-295 when erecting the new girders. See Table 6 for anticipated activities requiring 'full closures' and Table 7 for anticipated activities requiring 'single lane closures'.

	Full Replacement - Staged/ Conventional (2 Lanes)	Full Replacement - Staged/ Conventional (1 Lane)	Full Replacement - Temporary Bridge	Full Replacement - ABC Slide-in
Total Number of temp. *'Full Closures on I-295'*	***10***	***10***	***12***	***12***
Existing Structure Demolition	*4*	*4*	*2*	*2*
Steel Erection	*6*	*6*	*6*	*6*
Launch Temporary Bridge (& Remove Temp. Bridge)	*0*	*0*	*4*	*0*
Erect New Pier Cap Beam	*0*	*0*	*0*	*1*
Bridge Slide	*0*	*0*	*0*	*3*

Table 6: Summary of Full Closures on I-295

	Full Replacement - Staged/ Conventional (2 Lanes)	Full Replacement - Staged/ Conventional (1 Lane)	Full Replacement - Temporary Bridge	Full Replacement - ABC Slide-in
Total Number of temp. *'Single Lane Closures on I-295'*	***16***	***16***	***20***	***16***
Existing Structure Demolition	*4*	*4*	*4*	*4*
Formwork Set-up for Deck	*8*	*8*	*8*	*8*
Set-up Center Median Work Area	*4*	*4*	*4*	*4*
Prepare for Temporary Bridge Launch	*0*	*0*	*4*	*0*

Table 7: Summary of Single Lane Closures on I-295

Construction Duration

The 'Two Lane' and 'One Lane' construction approaches consider staged construction utilizing conventional construction techniques. A total of two construction seasons is anticipated for both approaches. During the first construction season, for both scenarios, the first stage of the new substructure and superstructure are proposed to be built offline. During the first year of construction, traffic on the Bucknam Road bridge would be unaffected.

At the start of the second construction season, in the 'Two Lane' approach, both lanes of Bucknam Road traffic would be rerouted to travel over the newly constructed portion of the bridge (constructed the previous season). Demolition of the existing Bucknam Road bridge and construction of the phase 2 portion are estimated to take approximately 120 calendar days

once traffic is detoured to the stage 1 portion. However, as two-way traffic is maintained throughout stage 2, the work on the stage 2 portion of the new bridge will have minimal impact on Bucknam Road traffic.

Similar to the 'Two Lane' approach, the 'One Lane' scenario would reroute one through lane of traffic to the newly constructed stage 1 portion and detour the other through lane to Lunt Road. Similarly, construction of the stage 2 portion is estimated to take approximately 120 calendar days once traffic is detoured. As only one lane of through traffic is maintained over the Bucknam Road bridge, the duration of the stage 2 work becomes more critical as detouring one lane of traffic over an extended period of time will negatively impact the traveling public.

The 'Temporary Bridge' approach is estimated to require one full construction season to complete the new bridge. This scenario requires that a temporary bridge to span over I-295, along with temporary approaches to tie into Bucknam Road, be erected/installed over the winter months/early spring so that rerouting Bucknam Road traffic to the temporary bridge can begin in March/April (beginning of the construction season). Once traffic is detoured to the temporary bridge, the total duration to construct the new bridge has less impact on the traveling public as two-way traffic will be maintained.

The 'ABC Slide-in' approach considers a condensed full closure window of Bucknam Road to demolish the existing bridge and install the new structure. This scenario requires the installation of new center pier footings (with deep foundations) and columns, outside of the existing bridge, installation of new abutment piles behind the existing abutments, and erection of the new superstructure immediately to the north of the existing bridge (supported on temporary shoring). All of this work is proposed to be completed while Bucknam Road is in-service with some work activities being performed at night during lane/full closures on I-295 or at night/during temporary lane closures on Bucknam Road (i.e. driving new abutment piles behind existing abutments). Once the above work is completed, the Bucknam Road bridge would be taken out of service for approximately 10 consecutive calendar days. During this closure period, the following activities would take place:

1. Demo existing bridge (2 days with 2 nights of full closures on I-295)
2. Set precast pier cap beam, precast abutment caps and grout (3 days requiring one night with full closures on I-295 for setting pier cap beam)
3. Prepare for lateral slide (1 day)
4. Perform lateral slide (3 days requiring full barrel closures on I-295)
5. Pave and stripe new bridge in-place (1 day)

Comparison Matrix

A comparison matrix was developed to show a summary of the evaluation criteria for the Bucknam Road bridge construction approaches. See Table 8.

Evaluation Matrix - Bucknam Road Bridge over Interstate 295, Falmouth, ME					
	CONSTRUCTION SCENARIOS	A	B	C	D
		Full Replacement - Staged/ Conventional (2 Lanes)	Full Replacement - Staged/ Conventional (1 Lane)	Full Replacement - Temporary Bridge	Full Replacement - ABC Slide-in
CONSTRUCTION COST	Superstructure	$2,171,000.00	$2,084,000.00	$1,985,000.00	$2,178,000.00
	Abutments	$602,000.00	$602,000.00	$516,000.00	$686,000.00
	Pier	$533,000.00	$533,000.00	$461,000.00	$883,000.00
	Structural Excavation & Borrow	$191,000.00	$151,000.00	$74,000.00	$74,000.00
	Existing Bridge Removal	$390,000.00	$390,000.00	$360,000.00	$360,000.00
	Detour/Temp. Bridge	$0.00	$0.00	$1,150,000.00	$0.00
	Lateral Slide	$0.00	$0.00	$0.00	$1,150,000.00
	Approaches	$437,000.00	$345,000.00	$186,000.00	$186,000.00
	Miscellaneous	$390,000.00	$371,000.00	$285,000.00	$277,000.00
	Mobilization	$433,000.00	$411,000.00	$474,000.00	$553,000.00
	Total Cost	$5,160,000.00	$4,890,000.00	$5,500,000.00	$6,350,000.00
TRAFFIC IMPACTS & USER COSTS	Anticipated worst-case impact to intersection LOS	D (Existing)	D	D (Existing)	F
	User Cost associated with delays from '*Full Closure of Bucknam Road Bridge*'	$6,368.00 per day			
	User Cost associated with delays from '*One-Way Thru Traffic on Bucknam Road Bridge*'	$2,062.00 per day			
	User Cost associated with delays from detour for '*Full Barrel Closures on I-295*' (NB + SB between 1:00 AM & 5:00 AM)	$1,161.00 per 4 hr full barrel night closure			
	Total User Cost from '*Full Closure of Bucknam Road Bridge*'	$0.00	$0.00	$0.00	$63,680.00
	Total User Cost from 'Partial *Closure of Bucknam Road Bridge*'	$0.00	$329,920.00	$0.00	$0.00
	Total User Cost from 'Full Barrel Closures on I-295'	$9,288.00	$9,288.00	$13,932.00	$13,932.00
	TOTAL USER COSTS DURING PARTIAL/FULL CLOSURE	**$9,288.00**	**$339,208.00**	**$13,932.00**	**$77,612.00**
CLOSURE DURATION	Overall Construction Duration	**2 Const. Seasons**	**2 Const. Seasons**	**1 Const. Season**	**1 Const. Season**
	Number of Days requiring *full closure* of Bucknam Road bridge	*0*	*0*	*0*	*10*
	Number of Days requiring *partial closure* of Bucknam Road bridge	*0*	*160*	*0*	*0*
	Total Number of temp. *'Full Barrel Closures on I-295'*	***8***	***8***	***12***	***12***
	Existing Structure Demolition	*2*	*2*	*2*	*2*
	Steel Erection	*6*	*6*	*6*	*6*
	Launch Temporary Bridge (& Remove Temp. Bridge)	*0*	*0*	*4*	*0*
	Erect New Pier Cap Beam	*0*	*0*	*0*	*1*
	Bridge Slide	*0*	*0*	*0*	*3*
	Total Number of temp. *'Single Lane Closures on I-295'*	***16***	***16***	***20***	***16***
	Existing Structure Demolition	*4*	*4*	*4*	*4*
	Formwork Set-up for Deck	*8*	*8*	*8*	*8*
	Set-up Center Median Work Area	*4*	*4*	*4*	*4*
	Prepare for Temporary Bridge Launch	*0*	*0*	*4*	*0*

Table 8: Evaluation Matrix

15. CONCLUSIONS & RECOMMENDATIONS

As discussed in *Section 13 – Summary of Design Alternatives*, a full replacement of the Bucknam Road bridge is recommended due to lower anticipated future maintenance costs and improved flexibility for future work on I-295. When considering the construction approach for this project, the costs associated with the project (construction & user) need to be weighed against both the severity and total duration of construction related traffic impacts.

'One Lane' offers the lowest estimated construction costs; however, the user costs associated with an approximate 160 calendar day duration of a single lane detour to Lunt Road results in the highest user costs of all scenarios considered.

The ‘ABC Slide-in’ option is estimated to have the highest construction costs due to the specialized equipment necessary to perform the lateral slide. This scenario also requires the full closure of the Bucknam Road bridge for 10 consecutive calendar days. Although the overall duration is relatively short, user costs associated with delays from detouring and reduced LOS at surrounding intersections, are very high on a daily basis. This results in the ‘ABC Slide-in’ option having the second highest user cost.

The ‘Two Lane’ scenario and ‘Temporary Bridge’ approach both allow for maintaining two lanes of traffic on Bucknam Road throughout construction and as a result are anticipated to have the least impact on the traveling public. However, the ‘Two Lane’ scenario is anticipated to require two construction seasons to be completed whereas the ‘Temporary Bridge’ approach could be completed in a single season by erecting the temporary bridge over the winter months. With multiple MaineDOT projects being constructed in Falmouth over the next several years, it is important to minimize construction durations and construction exposure to Falmouth residents and the traveling public. The ‘Two Lane’ scenario requires a large shift in alignment over the bridge to the north to facilitate maintenance of two-lanes of traffic during construction Phase 2. This results in increased approach widening and rework of the Bucknam Road/I-295 SB intersection immediately west of the bridge. The ‘Temporary Bridge’ approach allows the new bridge to be built in one phase and to be placed along a more optimized alignment that better matches the existing intersection west of the bridge and the proposed work at the intersection east of the bridge. The anticipated construction cost estimates for the two approaches are comparable, with the ‘Two Lane’ scenario anticipated to be approximately $350k less than the ‘Temporary Bridge’ approach. The ‘Temporary Bridge’ approach is anticipated to require four (4) additional full closures on I-295 to facilitate the erection/disassembly of the temporary bridge when compared to the ‘Two Lanes’ scenario.

It is recommended that the existing Bucknam Road bridge be replaced in its entirety with a new two-span structure to be constructed in a single phase, utilizing a temporary bridge to maintain two lanes of traffic on Bucknam Road throughout construction. This approach is preferred as it minimizes impacts to the traveling public by maintaining two-way traffic on Bucknam, minimizes construction exposure as the anticipated construction duration is a single season and provides flexibility in placement of the new bridge to best tie into the existing intersection west of the bridge and the proposed reconfiguration at the intersection east of the bridge.

The following design features are recommended for final design:

- The existing bridge (33’-0” out-to-out) shall be replaced in its entirety by a two-span fully integral bridge (52’-4” out-to-out).
- All concrete shall be cast-in-place.
- All structural steel shall be metalized.
- 9” CIP concrete composite deck (8” structural, 1” integral wearing surface).
- Reinforcing steel shall be stainless steel throughout the deck, approach slab, abutments, and pier.
- The existing Bucknam Road profile shall be adjusted to increase vertical clearance over I-295 to achieve a minimum 16’-0” under clearance.
- Approach roadway work to the east (horizontal alignment and vertical profile) shall be coordinated with the adjacent I-295 NB/Bucknam Road/Legion Road Intersection reconfiguration project (WIN22672) to ensure the two projects are adequately integrated at the proposed limits of work.

- Traffic on Bucknam Road shall be detoured to a temporary bridge located adjacent to the existing/proposed structure. Two lanes of traffic shall be maintained on Bucknam Road throughout construction.

The bridge replacement, using conventional construction techniques with a temporary bridge is estimated at $5.28 million and the approach modification cost is $0.220 million. The resulting total construction only cost is approximately $5.50 million. The total project cost, including PE, ROW, Construction and CE is $5.905 million. The preliminary cost estimate for the recommended alternative is included in Appendix K.

The proposed project schedule targets advertisement for construction in July 2019 with construction beginning in winter 2019/2020. The project should be completed in one construction season.

Appendix A

Preliminary Plans

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

SPECIFICATIONS

Design: Load and Resistance Factor Design per
AASHTO LRFD Bridge Design Specifications,
Eigth Edition, 2017.

DESIGN LOADING

Live Load ..... HL - 93 Modified for Strength I

TRAFFIC DATA

Current (2018) AADT	14,010
Future (2038) AADT	16,810
DHV - % of AADT	10%
Design Hour Volume	1750
% Heavy Trucks (AADT)	3%
% Heavy Trucks (DHV)	2%
Directional Distribution (DHV)	63%
18 kip Equivalent P 2.0	174
18 kip Equivalent P 2.5	166
Design Speed (mph)	35

MATERIALS

Concrete:	
Curbs and Transition Barriers	Class "LP"
All Other	Class "A"
Reinforcing Steel	
Stainless Steel	ASTM A955/A955M, Grade 75
Structural Steel:	
All Material (except as noted)	ASTM A709, Grade 50 (Metalized)
High Strength Bolts	ASTM F3125, Grade A325 Type 1 (Galvanized)

BASIC DESIGN STRESSES

Concrete:	
Class "LP"	f'c = 5,000 psi
Class "A"	f'c = 4,000 psi
Reinforcing Steel:	
Stainless	f y = 75,000 psi
Structural Steel:	
ASTM A709, Grade 50	F y = 50,000 psi
ASTM F3125, Grade A325, Type 1	F u = 120,000 psi

FALMOUTH
CUMBERLAND COUNTY
BUCKNAM ROAD BRIDGE
OVER
INTERSTATE 295
PROJECT NO. 021720.00
PROJECT LENGTH 0.13 mi
BRIDGE NO. 5830

INDEX OF SHEETS

UTILITIES

Central Maine Power Company
Consolidated Communications

MAINTENANCE OF TRAFFIC

Install temporary bridge to maintain
two lanes of traffic on Bucknam Road
throughout construction.

PROJECT LOCATION:	On Bucknam Road Over Interstate 295 Latitude 43°43'40" N Longitude 70° 14'13" W
PROGRAM AREA:	Bridge Program
OUTLINE OF WORK:	Bridge Replacement

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
APPROVED — DATE
COMMISSIONER:
CHIEF ENGINEER:

PROJECT INFORMATION

PROGRAM	BRIDGE PROGRAM		
PROJECT MANAGER	JOEL KITTREDGE	SIGNATURE	
DESIGNER	ADAM STOCKIN, P.E.	P.E. NUMBER	
CONSULTANT	WSP USA		
PROJECT RESIDENT		DATE	
CONTRACTOR			
PROJECT COMPLETION DATE			

WIN 21720.00

021720.00

FALMOUTH
BUCKNAM ROAD BRIDGE

TITLE SHEET

SHEET NUMBER
1
OF 7

Date:9/13/2018
Username:
Division:
Filename:\cadd\001_TITLE.dgn

OWNER:
STATE OF MAINE
DEPT. OF TRANSPORTATION
OPERATOR:
ST. LAWRENCE & ATLANTIC
RAILROAD COMPANY
V26_20 STA 8380-8572
V26/S20 STA 8410 TO STA 8463
BOOK/PAGE 25500/215

STATE OF MAINE
BOOK/PAGE 2443/108

Limit of Ramp Work
Match Existing

Remove and
Reset Signs

STA 94+67.38
Limit of Work
Match Existing

Reconstruct Existing
Rasied Island

Match Existing Guardrail

W-Beam Guardrail - Mid-way Splice

℄ Brg. Abutment No. 1
Sta. 97+41.34

Proposed ℄
Bucknam Road

PT = STA. 902+40.17

Proposed 3 Bar
Traffic/Bicycle
Railing

5'-0"
Shldr.

℄ Brg. Pier
Sta. 98+59.84

℄ Brg. Abutment No. 2
Sta. 99+78.34

PC = STA. 904+75.42

Remove and Relocate
Utility Pole

MATCH LINE

94+00 | 899+65 | 95+00 | S 57°26'54.13" E | 96+00 | 97+00 | 98+00 | 99+00 | 100+00

900+00 | 901+00 | 902+00 | 903+00 | S 57°26'01.96" E 904+00 | 905+00

Remove and Relocate
Utility Pole

11'-0" Lane
11'-0" Lane

5'-0"
Shldr.

6'-0"
Sidewalk

Construct Sidewalk

W-Beam Guardrail -
Mid-way Splice

Proposed 4 Bar
Traffic/Pedestrian
Railing

Painted Median

Temporary Bridge
Alignment

I-295
SOUTH BOUND

I-295
NORTH BOUND

CONTROL OF ACCESS LIMIT

PC = STA. 899+64.70

Remove and
Relocate Signs

Limit of Work
Match Existing
Driveway

25' Radius

Fill Slope Limit
(Typ.)

Remove and Reset Fence

CONTROL OF ACCESS LIMIT

W-Beam Guardrail -
Mid-way Splice
Tangent Terminal

Terminal End
(Typ.)

PRC = STA. 900+99.43

PI = STA. 99+28.74

W-Beam Guardrail -
Mid-way Splice

Construction Limits (Typ.)

MATCH LINE

LISA H. & TODD P.
LALUMIERE REVOCABLE
TRUST
MAP 234 LOT U24-27
BOOK/PAGE 28586/29
POR-7

LISA H. & TODD P.
LALUMIERE REVOCABLE
TRUST
MAP 234 LOT U24-27
BOOK/PAGE 28586/29
POR-7

TOWN OF FALMOUTH
MAP 234 LOT U58-3-C
BOOK/PAGE
POR-1

TEMP. DETOUR
CURVE DATA #1
PI = 900+33.18
D = 18°47'07.8"
Δ = 25°18'39.3" Rt.
R = 305.00'
L = 134.74'
T = 68.49'
E = 7.59'

TEMP. DETOUR
CURVE DATA #2
PI = 901+70.99
D = 18°11'20.9"
Δ = 25°35'53.6" Lt.
R = 315.00'
L = 140.73'
T = 71.56'
E = 8.03'

PLAN
25 0 25
Scale

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

21720.00

WIN
21720.00

BRIDGE No 5830

BRIDGE PLANS

SIGNATURE

P.E. NUMBER

DATE

	BY	DATE
PROJ. MANAGER	J. KITTREDGE	
DESIGN-DETAILED	KLH	9/18
CHECKED-REVIEWED	RAB	9/18
DESIGN-DETAILED2		
DESIGN-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND

PRELIMINARY PLAN (1 OF 2)

SHEET NUMBER
2
OF 7

Date:9/13/2018
Username:
Division:
Filename:\cad\0\002_General Plan1.dgn

STATE OF MAINE

MATCH LINE

CURVE DATA #1
PI = 106+64.84
D = 1°30'00.0"
Δ = 15°58'43.6" Lt.
R = 3819.72'
L = 1065.25'
T = 536.10'
E = 37.44'

PC = STA. 101+28.74

STA 906+13.16

W-Beam Guardrail - Mid-way Splice

Proposed ℄ Bucknam Road

TO ROUTE 9 / MIDDLE ROAD

S 57°21'47.77" E

101+00 102+00 103+00 104+00 105+00 106+00 107+00

TO U.S. ROUTE 1

907+00 907+41

Pointed Median

Construct Sidewalk

Remove and Relocate Utility Pole

W-Beam Guardrail - Mid-way Splice

STA 102+55.23
End Project
Match WIN 22672

CONTROL OF ACCESS LIMIT

MMC REALTY CORP
MAP 240 LOT U58-10
BOOK/PAGE 16058/230
POR-3

Fill Slope Limit (Typ.)

PT = STA. 907+40.63

TIMOTHY & JILL STOREY
MAP 234 LOT U58-3-A
BOOK/PAGE 17840/66
POR-2

TOWN OF FALMOUTH
MAP 240 LOT U58-4
BOOK/PAGE 3217/193
POR-4

EXISTING SLOPE EASEMENT

EXISTING SLOPE EASEMENT

TEMP. DETOUR
CURVE DATA #3
PI = 905+45.52
D = 19°05'54.9"
Δ = 26°18'21.2" Lt.
R = 300.00'
L = 137.74'
T = 70.10'
E = 8.08'

TEMP. DETOUR
CURVE DATA #4
PI = 906+77.87
D = 19°05'54.9"
Δ = 24°20'43.0" Rt.
R = 300.00'
L = 127.47'
T = 64.71'
E = 6.90'

PLAN

25 0 25 50
Scale

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

21720.00

WIN 21720.00

BRIDGE No 5830

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER J. KITTREDGE		
DESIGN-DETAILED	KLH	9/18
CHECKED-REVIEWED	RAB	9/18
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1		
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

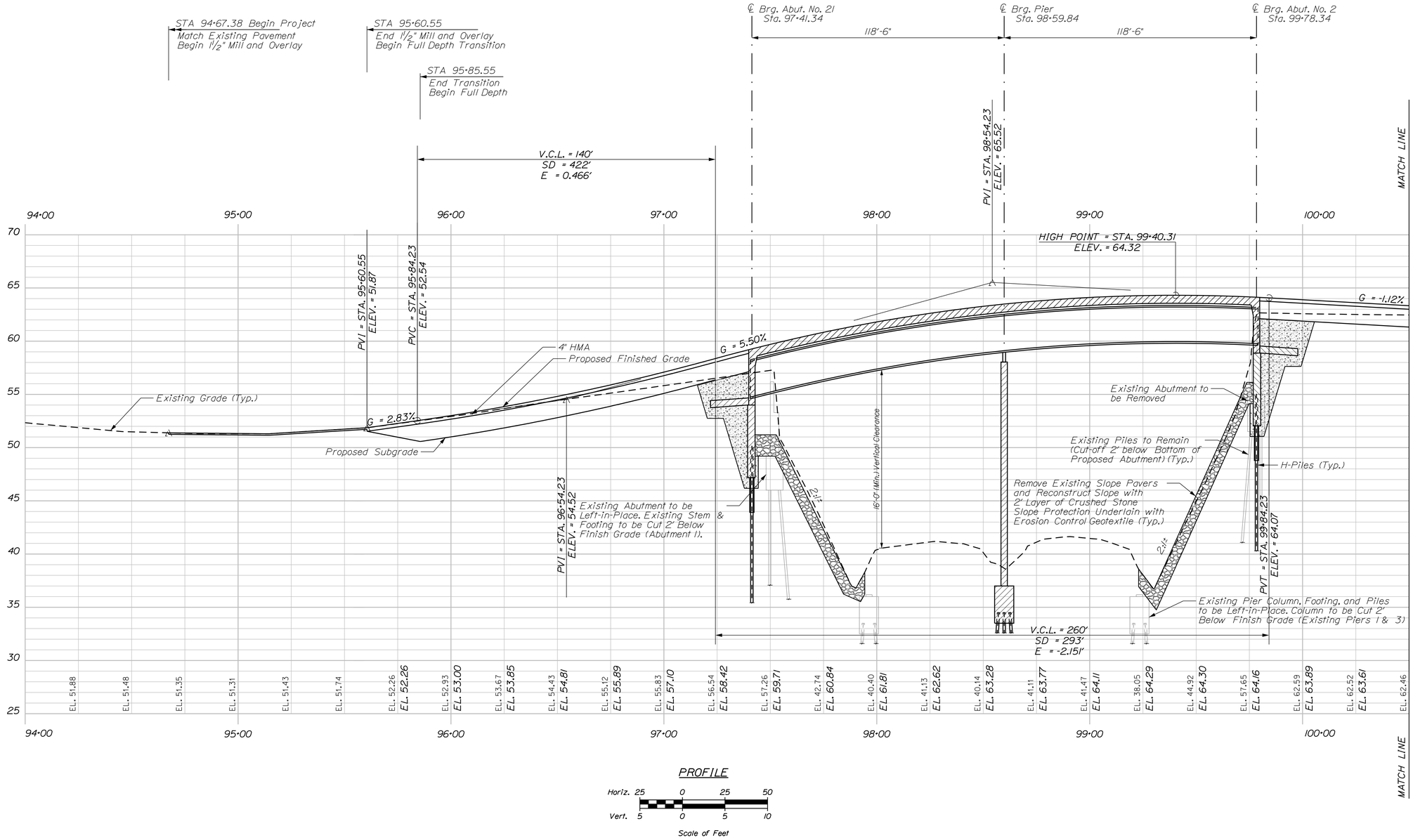
P.E. NUMBER

DATE

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND

PRELIMINARY PLAN (2 OF 2)

SHEET NUMBER
3
OF 7



PROFILE

Horiz. 25 0 25 50

Vert. 5 0 5 10

Scale of Feet

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

21720.00

WIN 21720.00

BRIDGE No. 5830

BRIDGE PLANS

		BY	DATE
PROJ. MANAGER	J. KITTREDGE		
DESIGN-DETAILED	KLH	KLH	9/18
CHECKED-REVIEWED	RAB	RAB	9/18
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND

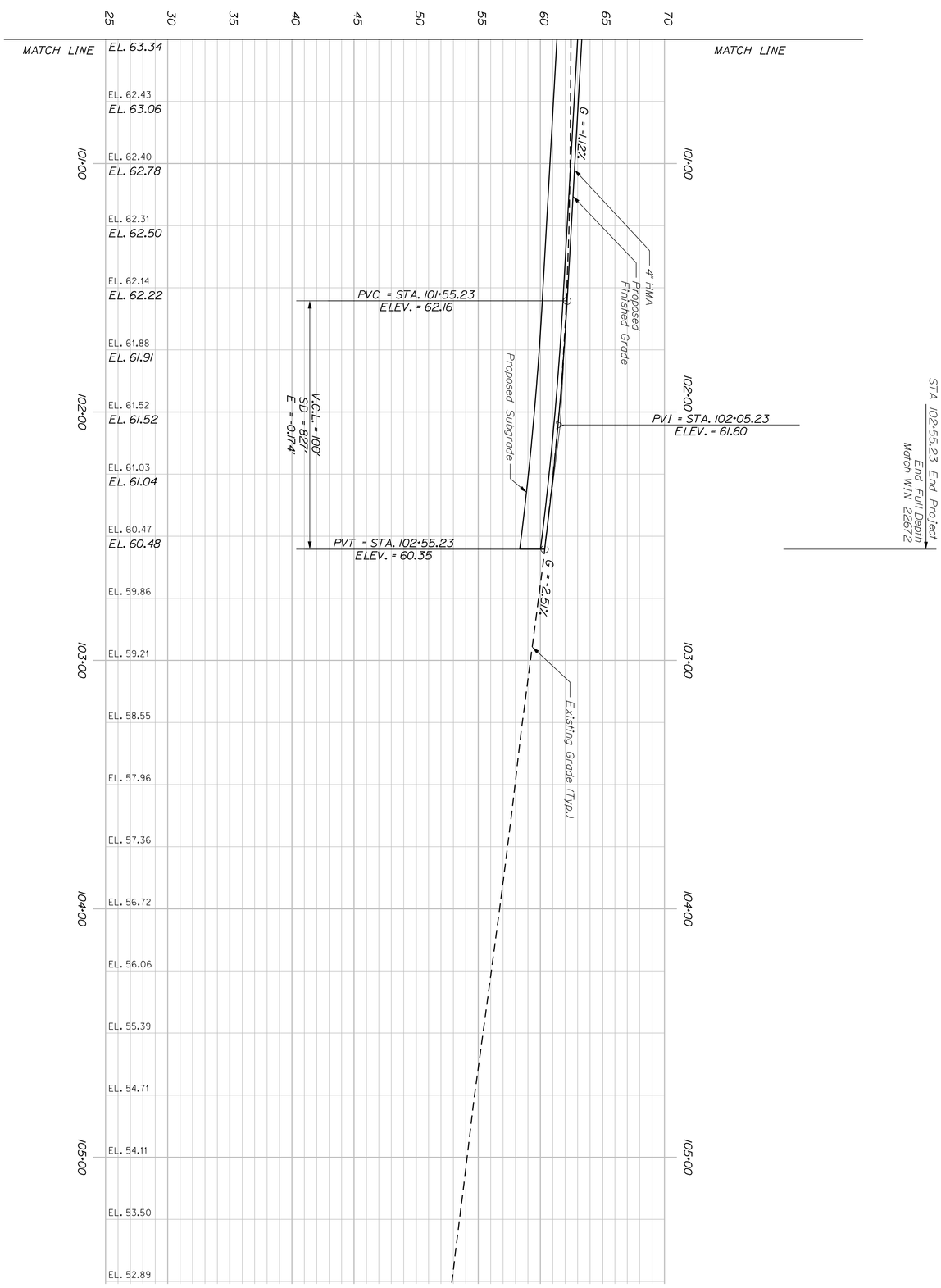
PROFILE (1 of 2)

SHEET NUMBER

4

OF 7

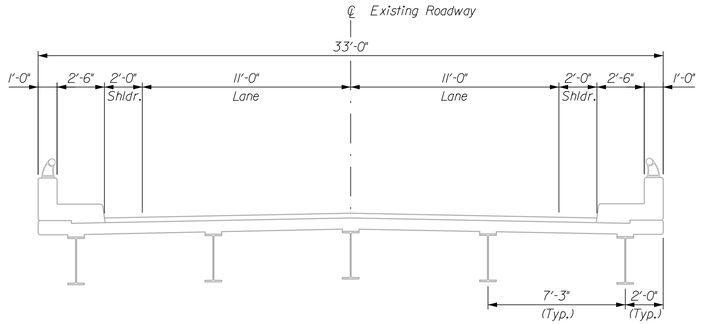
Filename: ...\cadd\004_Profile.dgn Division: Username: Date:9/13/2018



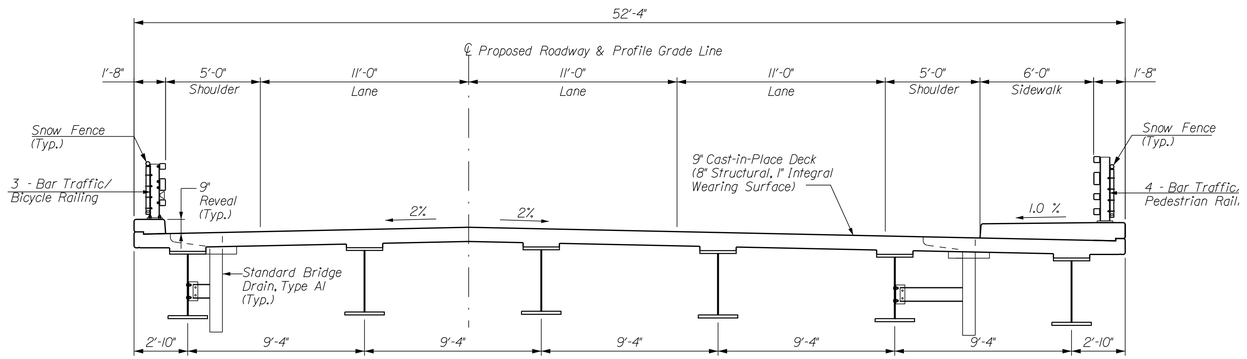
SHEET NUMBER 5 OF 7	BUCKNAM ROAD BRIDGE INTERSTATE 295 FALMOUTH CUMBERLAND PROFILE (2 of 2)	PROJ. MANAGER J. KITTREDGE	BY	DATE	STATE OF MAINE DEPARTMENT OF TRANSPORTATION
		DESIGN-DETAILED	KLH	9/18	
		CHECKED-REVIEWED	RAB	9/18	SIGNATURE
		DESIGN2-DETAILED2			
		DESIGN3-DETAILED3			P.E. NUMBER
		REVISIONS 1			
		REVISIONS 2			DATE
		REVISIONS 3			
		REVISIONS 4			
		FIELD CHANGES			

21720.00

BRIDGE No. 5830 WIN 21720.00 BRIDGE PLANS



EXISTING BRIDGE SECTION



PROPOSED BRIDGE SECTION

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

021720.00

WIN 21720.00

BRIDGE No. 5830

BRIDGE PLANS

PROJ. MANAGER	J. KITTREDGE	BY	DATE
DESIGN-DETAILED	TWP	TWP	9/18
CHECKED-REVIEWED	AMS	AMS	9/18
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND

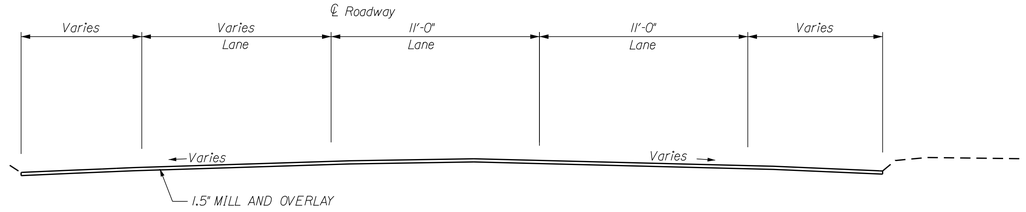
TYPICAL SECTIONS (1 of 2)

SHEET NUMBER

6

OF 7

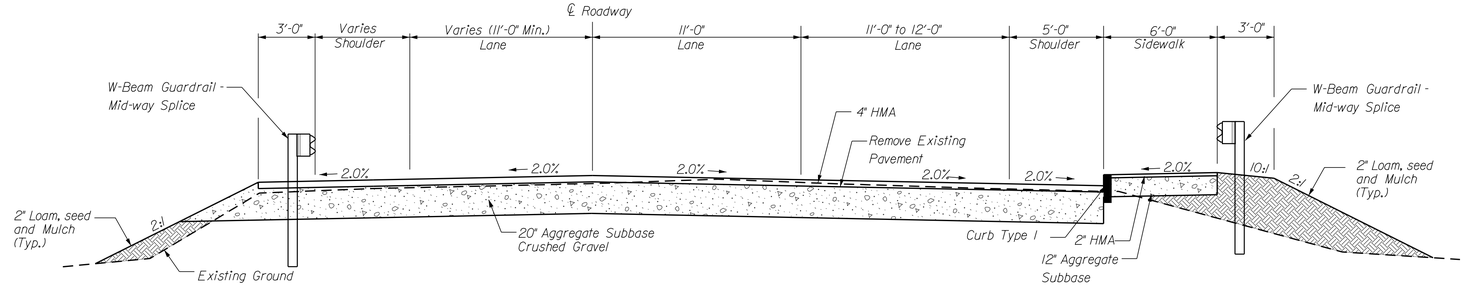
Filename: ...\cadd\006_BridgeTypical.dgn Division: Username: Date:9/13/2018



TYPICAL MILL & OVERLAY SECTION

STA 94+67.38 TO STA 95+60.55

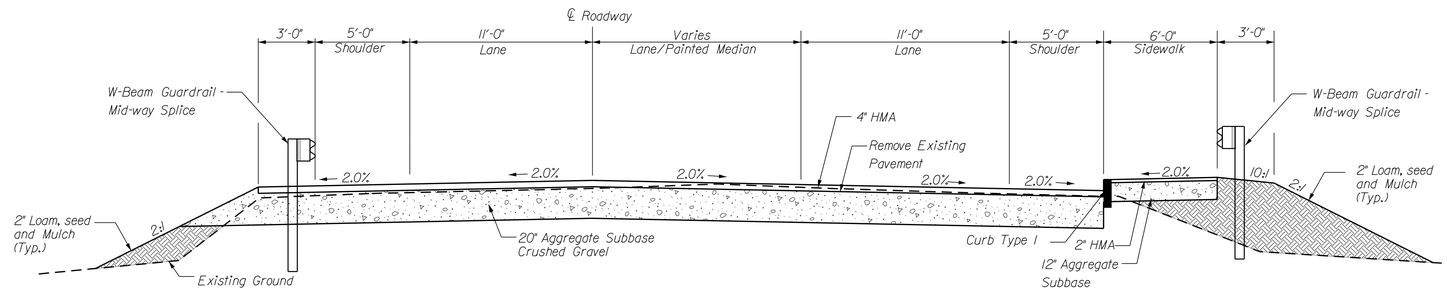
Scale: 1/4" = 1'-0"



WESTERN APPROACH SECTION

STA 95+60.55 TO STA 97+41.23

Scale: 1/4" = 1'-0"



EASTERN APPROACH SECTION

STA 99+78.34 TO STA 102+55.23

Scale: 1/4" = 1'-0"

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

021720.00

WIN 21720.00

BRIDGE No. 5830

BRIDGE PLANS

PROJ. MANAGER	J. KITTREDGE		
DESIGN-DETAILED	KLH	KLH	9/18
CHECKED-REVIEWED	RAB	RAB	9/18
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1			
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

BUCKNAM ROAD BRIDGE
INTERSTATE 295
FALMOUTH CUMBERLAND

TYPICAL SECTIONS (2 of 2)

SHEET NUMBER

7

OF 7

Filename: ...\007_App Typical Sections.dgn Division: Username: Date:9/13/2018

Appendix D

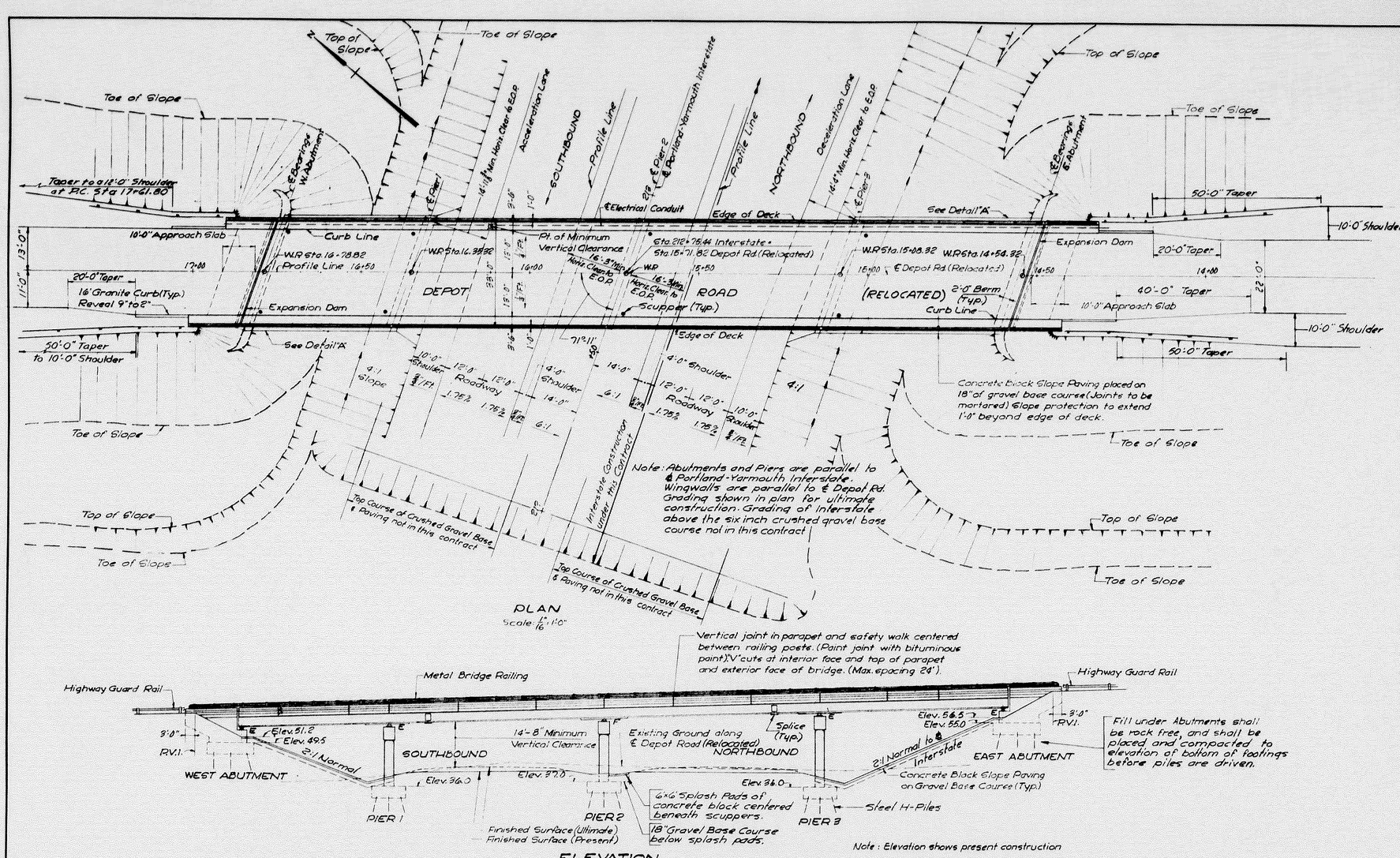
Existing Bridge Plans

S. R. P. REQ. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-2(6)	22	50

FALMOUTH

GENERAL NOTES

1. **SPECIFICATIONS**
   AASHO 1953
   Maine State Highway Commission, Standard Specifications Highway and Bridges 1956 and special Provisions.
2. **LIVE LOAD**
   H 20-S16-Modified.
3. **FOUNDATIONS**
   Steel H Piles
   Design Capacity - 35 Tons
4. **ALLOWABLE STRESSES**
   Structural Steel - 18,000 p.s.i.
   Reinforcing Steel - 18,000 p.s.i.
   Concrete - 1,200 p.s.i.
5. **CONCRETE**
   Class "A" Footings, Piers, Abutments, Approach Slabs and Deck.
6. **ELEVATIONS**
   Elevations are based on Elev. 0.00 at Mean Sea Level.



ESTIMATED QUANTITIES

ITEM	DESCRIPTION	UNIT	QUANTITY
204-14	Structural Earth Excavation, Piers	C.Y.	380
302-7	Gravel Base Course, In Place Measurement	C.Y.	250
307-8	Reinforced Portland Cement Concrete Approach Slabs.	S.Y.	58
404-28	Bituminous Concrete Surface Course, Type "A"	Ton	85
701-33	Portland Cement Concrete, Abutments and Retaining Walls.	C.Y.	200
701-37	Portland Cement Concrete, Substructure Columns, Column Bases, Bents, Collision Walls, Girders, Struts, Etc.	C.Y.	190
701-40	Portland Cement Concrete, Roadway and Sidewalk Slabs on Steel Bridges.	C.Y.	250
701-42	Portland Cement	Bbl.	960
701-50	Wrought Iron Scuppers	Each	8
702-103	Structural Steel, Fabricated and Delivered	Lbs.	178,000
702-104	Structural Steel, Erection	Lbs.	178,000
705-13	Reinforcing Steel, Delivered	Lbs.	90,000
705-14	Reinforcing Steel, Placing	Lbs.	90,000
708-16	Steel H Beam Piles 42 Lbs./Ft.	Lin. Ft.	* 8,400
709-6	Membrane Waterproofing	S.Y.	716
710-6	Waterproofing Joints	Lin. Ft.	69
804-6	French Drains	C.Y.	56
806-7	Aluminum Rail, Delivered and Erected	Lin. Ft.	518
907-12	Slope Paving for Bridge	S.Y.	447
927-6	Electrical Conduit - 3"	L.F.	265

* Includes 294 L.F. allowance for Pile Caps and 100 L.F. allowance for Pile Splices.

DES.	L.R.V. R.W.A.
DR.	R.M.L. M.L.
TR.	
CHK.	R.P.W.
APP'D.	

AS BUILT - NO REVISION

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

GENERAL PLAN AND ELEVATION

SHEET NO. 22 OF 50 | SCALE: AS NOTED

M-1301

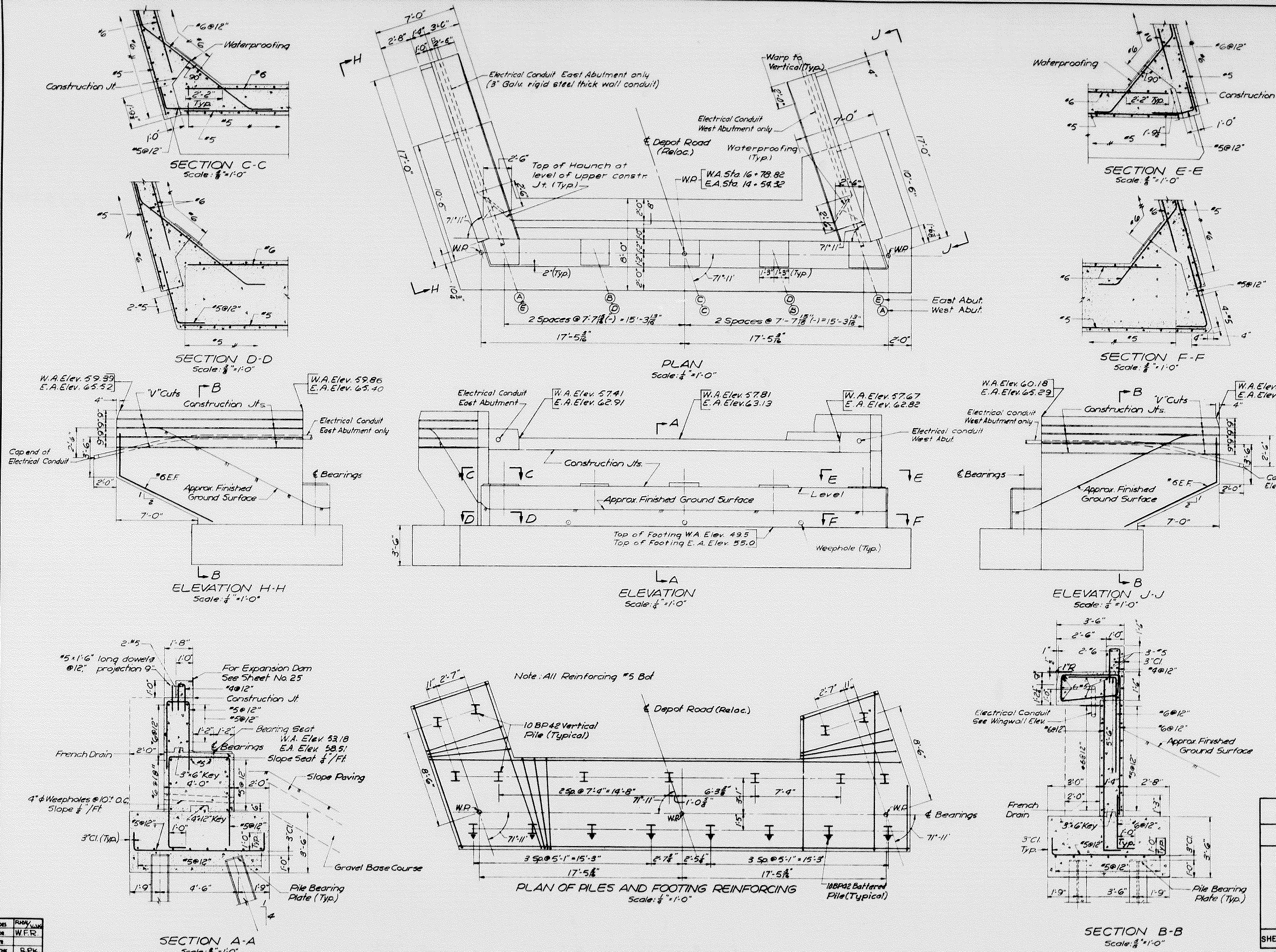
FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.

Qm-14
365

Boston Blue Print-300-4-57

S.R.R. Reg. No.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-3(6)	23	50

FALMOUTH



BEARING PAD ELEVATIONS		
STRINGER	WEST ABUTMENT	EAST ABUTMENT
A	53.65	58.78
B	53.70	58.92
C	53.77	59.04
D	53.55	58.87
E	53.35	58.68

NOTES
For typical details see Sheet No. 24
For construction notes see Sheet No. 24

LEGEND
W.A. - West Abutment
E.A. - East Abutment
W.P. - Working Point
E.F. - Each Face

AS BUILT - NO REVISION

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

ABUTMENT DETAILS

SHEET NO. 23 OF 50 | SCALE: AS NOTED

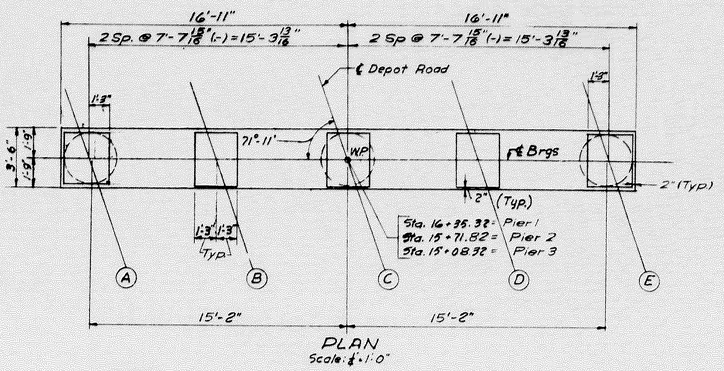
M-1302 FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS. Qm-14 366

DES. RHW/VJW
DR. W.F.R.
CHK. R.P.K.

Boston Blue Print

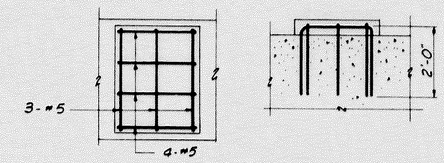
B. & S.-P. Sys. Ref. No.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-3(6)	24	50

FALMOUTH



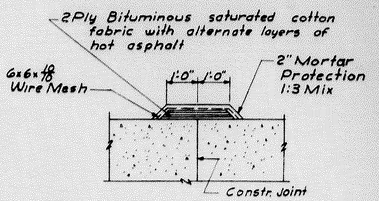
PLAN
Scale: 1/4" = 1'-0"

BEARING PAD ELEVATIONS			
STRINGER	PIER 1	PIER 2	PIER 3
A	54.64	56.70	57.79
B	54.71	56.78	57.90
C	54.79	56.87	58.00
D	54.56	56.45	57.80
E	54.35	56.45	57.62

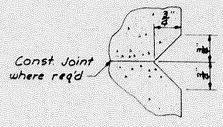


PLAN ELEVATION

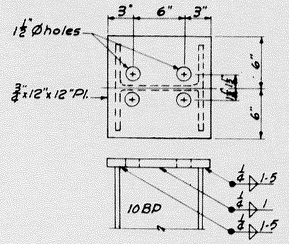
BEARING PAD DISTRIBUTION STEEL
TO BE USED WHERE TOP OF PAD IS 4" OR MORE ABOVE ABUTMENT BRIDGE SEAT OR PIER CAP
Scale: 1/2" = 1'-0"



WATERPROOFING DETAIL
Scale: 1/2" = 1'-0"

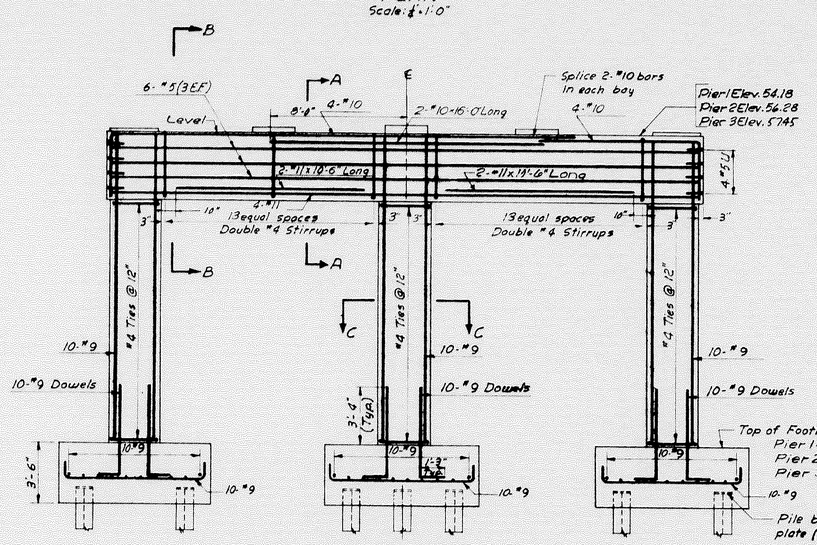


TYPICAL V-CUT DETAIL
Half Size

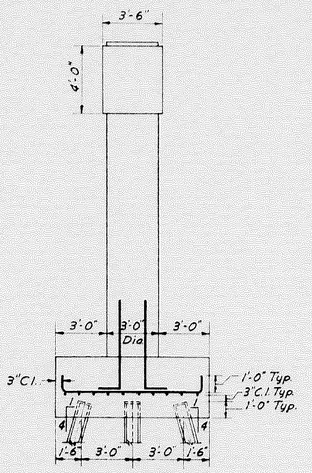


PILE BEARING PLATE
Scale: 1 1/2" = 1'-0"

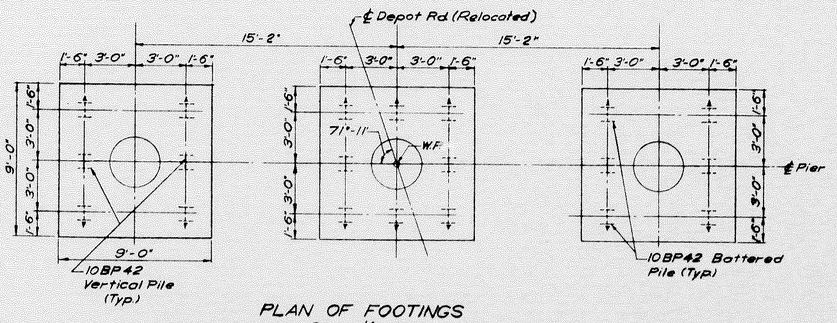
TYPICAL DETAILS
Scale: As Noted



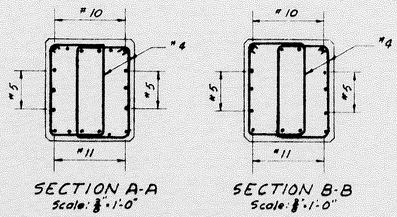
ELEVATION
Scale: 1/4" = 1'-0"



END ELEVATION
Scale: 1/4" = 1'-0"

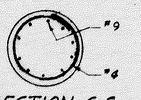


PLAN OF FOOTINGS
Scale 1/4" = 1'-0"



SECTION A-A
Scale: 1/2" = 1'-0"

SECTION B-B
Scale: 1/2" = 1'-0"



SECTION C-C
Scale: 1" = 1'-0"

Construction Notes
1. Reinforcing steel to have 2" min. concrete cover unless otherwise noted.
2. All bar splices to lap 20 diameters (12" min.) unless otherwise noted.
3. All bar embedments to be 35 diameters unless otherwise noted.
4. Bearing pads to be of sufficient height to permit bush hammering to the proper elevation.
5. All bearing pads to be placed integrally with the piers and abutments.
6. All exposed corners except on bearing pads to have a 3/4" chamfer. Bearing pads to have tooled edges.
7. Reinforcing steel in or beneath bearing pads to be positioned to clear swedge anchor bolts. For swedge anchor bolts see bearing types on Sh. No. 28

DES.	R.P.K.
DR.	DAM
TR.	
CHK.	R.P.K.
APP'D.	

Boston Blue Print-300-4-47

AS BUILT - NO REVISION

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

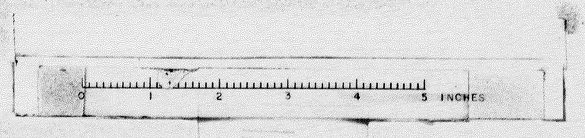
PIER DETAILS

SHEET NO. 24 OF 50 | SCALE: AS NOTED

M-1303

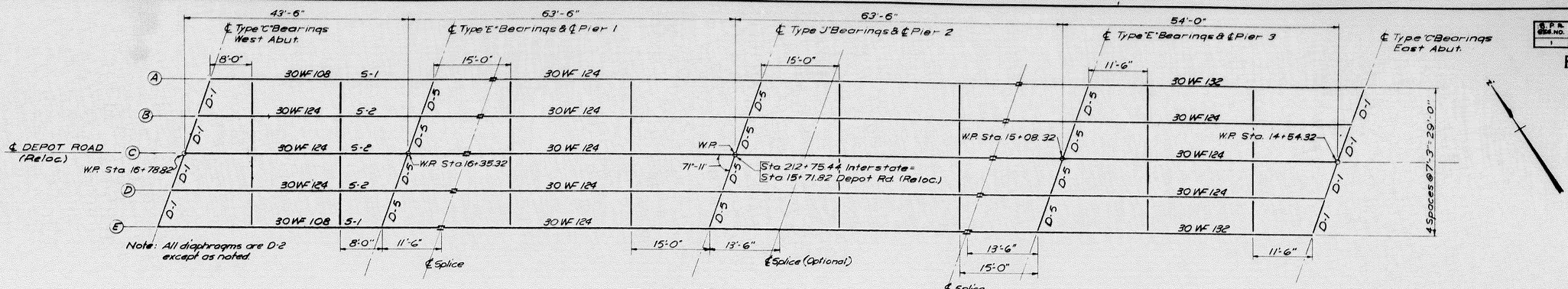
FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.

Qm-14 367

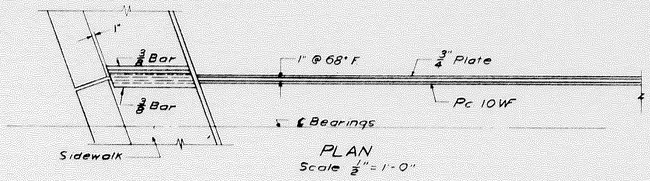


S. P. & DEV. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-3(6)	25	50

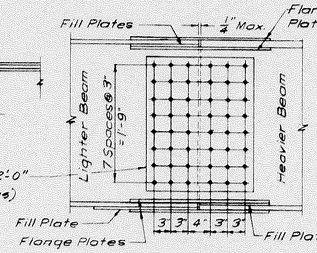
FALMOUTH



FRAMING PLAN
Scale: 1"=10'-0"

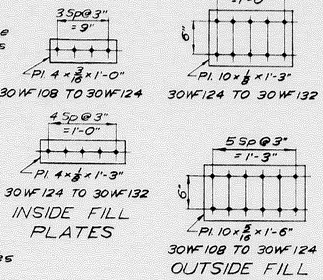


PLAN
Scale 1/2"=1'-0"



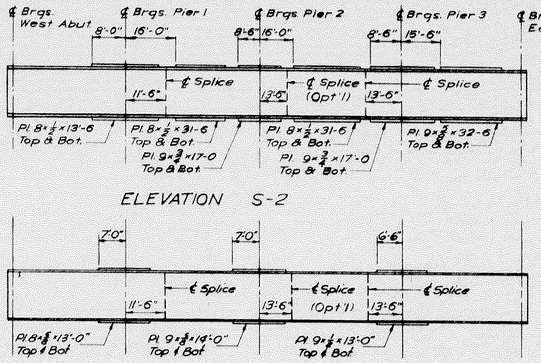
ELEVATION

2 Pls. 19 × 7/16 × 2'-0" (All Splices)



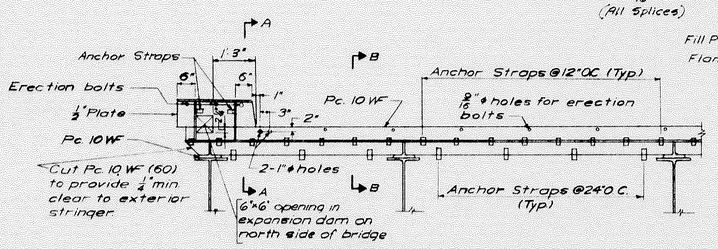
INSIDE FILL PLATES

OUTSIDE FILL PLATES

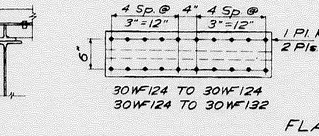


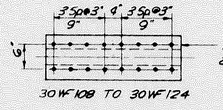
ELEVATION S-2

ELEVATION S-1

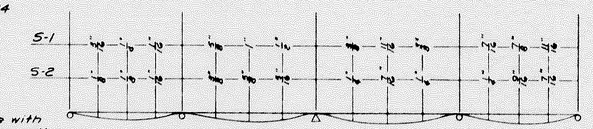


ELEVATION
Scale: 1/2"=1'-0"





FLANGE PLATES

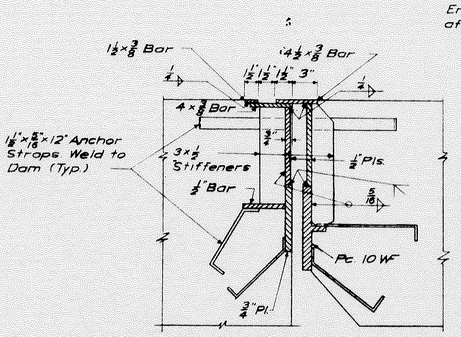


DEAD LOAD DEFLECTION DIAGRAM
No Scale
Deflections are given at 1/4 pts. in each span

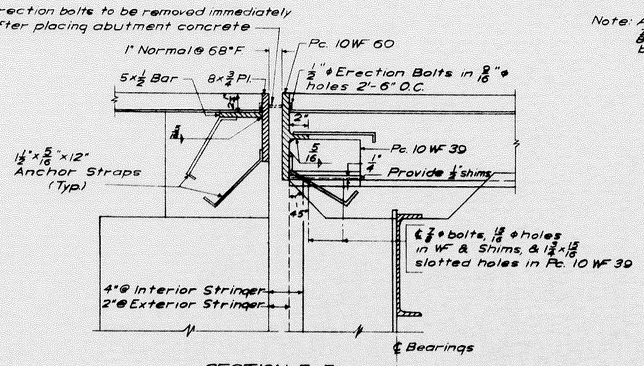
Note: Where rolled stringers have cover plates, the steel for both shall conform to ASTM A-373. All other structural steel shall conform to ASTM A-7 or A-373 unless specified otherwise.

STRINGER SPLICE DETAILS
No Scale

Note: All splices to be made with 7/8" ϕ rivets or high strength bolts in 15/16" ϕ holes.



SECTION A-A
Scale: 1 1/2"=1'-0"



SECTION B-B
Scale: 1 1/2"=1'-0"

EXPANSION DAM DETAILS

FRAMING NOTES

1. For diaphragm and bearing details see Sheet No. 28
2. All dimensions shown on framing plan are horizontal.
3. Stringers not to be cambered but shall be erected with natural bow up. Camber to follow road profile to be obtained by angular adjustment at splices.
4. All ℄ Bearings are parallel.
5. All Stringers are parallel to ℄ Depot Rd.

AS BUILT - NO REVISION

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

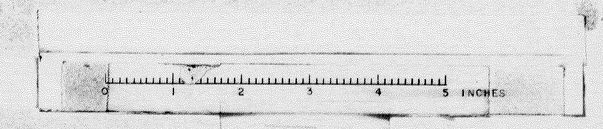
FRAMING PLAN AND DETAILS

SHEET NO. 25 OF 50 | SCALE: AS NOTED

DES.	R.H.W. SEP.
DR.	A.R.C.
TR.	
CHK.	R.P.K.
APP'D.	

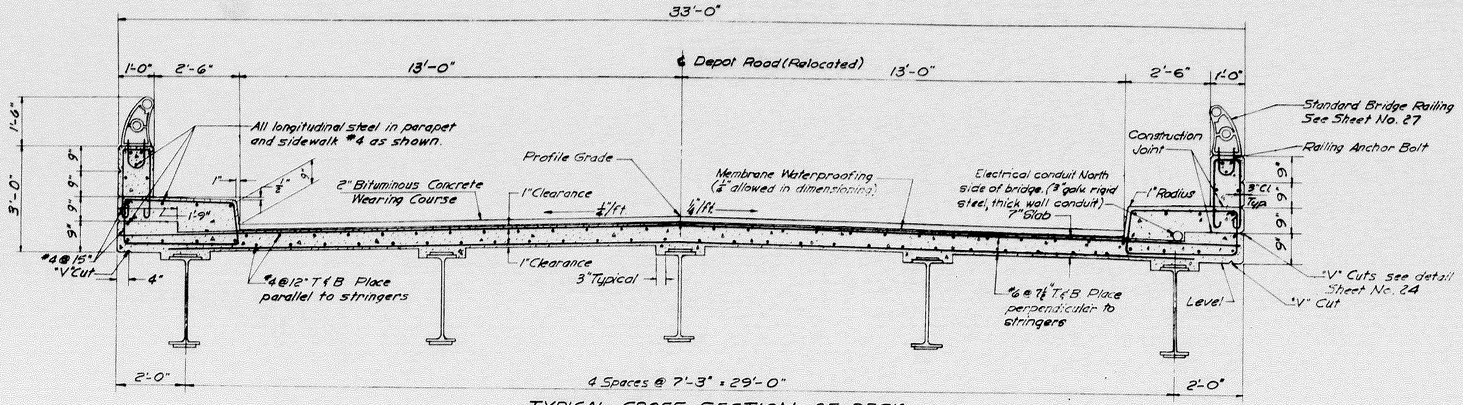
Boston Blue Print-200-4-57

M-1304 FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS. Qm-14 3/58

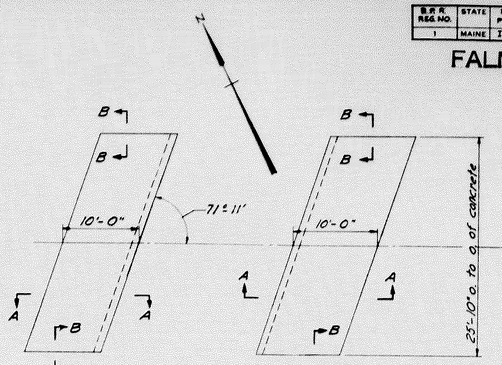


B.R.R. R&E NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-3(6)	26	50

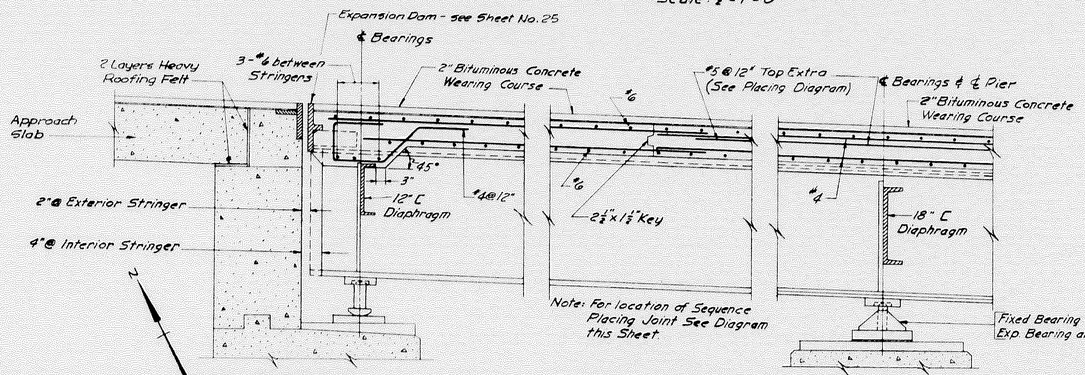
FALMOUTH



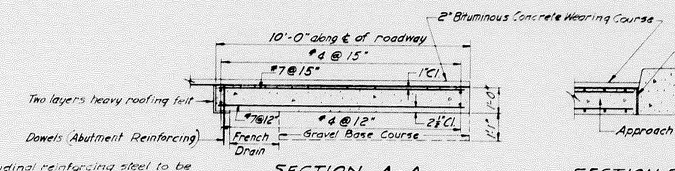
TYPICAL CROSS SECTION OF DECK
Scale: 1/2" = 1'-0"



PLAN OF APPROACH SLABS
Scale: 1/8" = 1'-0"



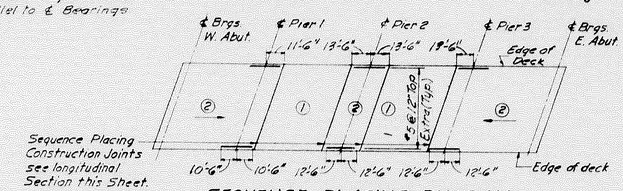
SEQUENCE PLACING JOINT LONGITUDINAL SECTIONS
Scale: 3/8" = 1'-0"



Note: Longitudinal reinforcing steel to be placed parallel to ℄ Depot Road. Transverse reinforcing steel to be placed parallel to ℄ Bearings

SECTION A-A
Scale: 3/8" = 1'-0"

SECTION B-B
Scale: 3/8" = 1'-0"

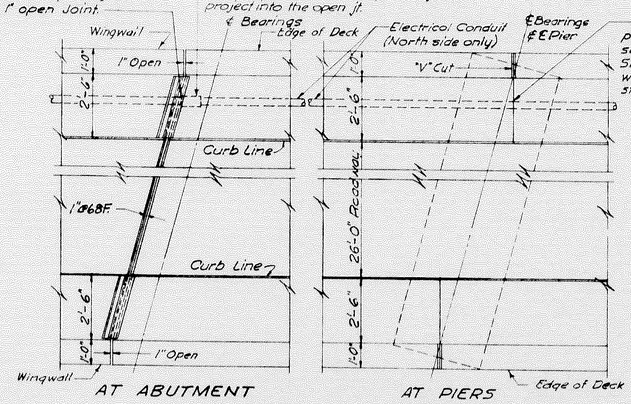


SEQUENCE PLACING DIAGRAM
No Scale

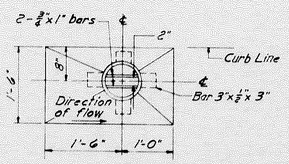
Notes for Placing:
Slabs designated by ① shall be placed before those marked ②. Slabs of the same number may be placed simultaneously or in sequence. Slabs may be placed starting from either end unless the direction of placing concrete is shown with an arrow. Once the placing of a slab has been started, it shall be completed without interruption.

Note for Screeds:
After structural steel has been erected, levels are to be run on top flanges of stringers. Screeds for slab are to be set on the basis of these levels corrected for ⅔ of the dead load deflection shown on Sheet No. 25
Changes in screed elevations will not be allowed on continuous structures after any portion of the deck slab has been placed.

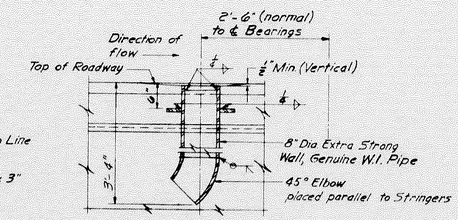
Notes: For location of scuppers, see Sheet No. 22
For construction notes, see Sheet No. 24



PART PLAN OF DECK
Scale: 3/8" = 1'-0"



PLAN



SECTION THRU SCUPPER

SCUPPER DETAIL
Scale: 3/8" = 1'-0"

AS BUILT - NO REVISION

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

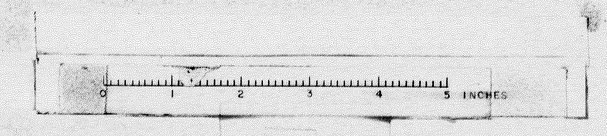
CROSS SECTION AND DETAILS

SHEET NO. 26 OF 50 | SCALE: AS NOTED

DES	RHW
DR	F.W.
TR	
CHK	RPK
APP'D	

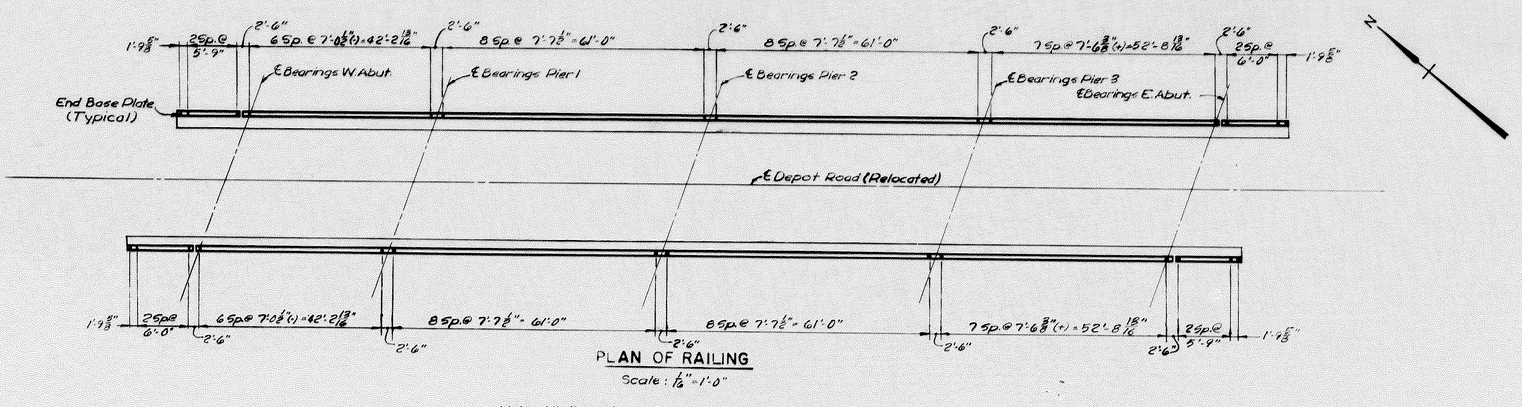
Boston Blue Print-300-4-51

M-1305 FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS. Qm-14 369



S. P. R. Reg. No.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-1(6)	27	50

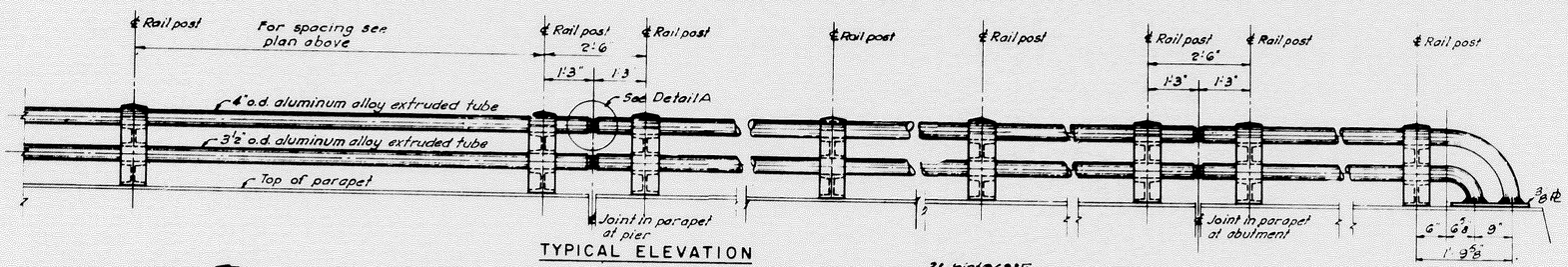
FALMOUTH



PLAN OF RAILING

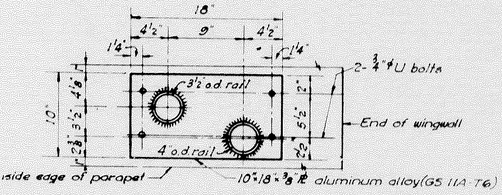
Scale: 1/2" = 1'-0"

Note: All dimensions shown on plan are horizontal.



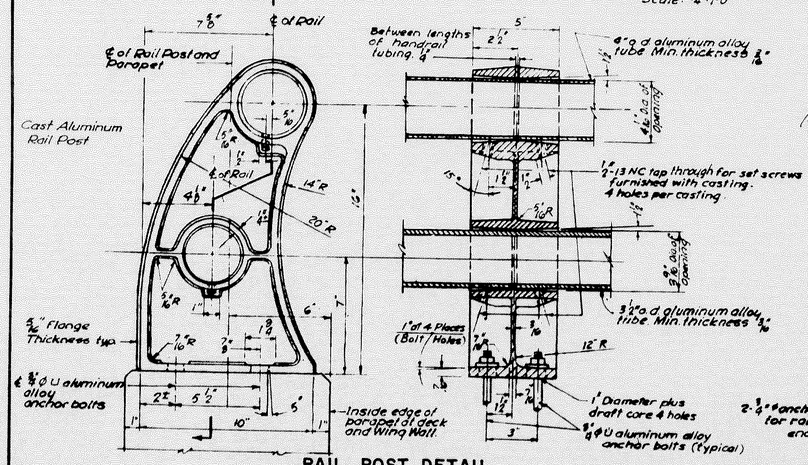
TYPICAL ELEVATION

Scale: 3/4" = 1'-0"



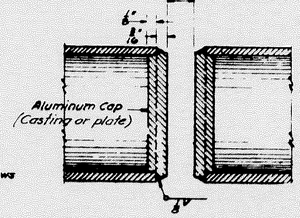
DETAIL OF END BASE PLATE

Scale: 1 1/2" = 1'-0"



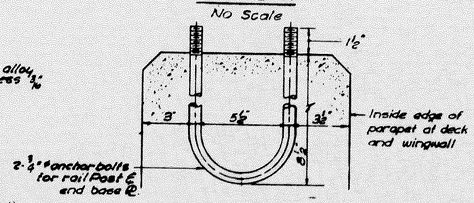
RAIL POST DETAIL

Scale: 3" = 1'-0"



DETAIL A

No Scale



DETAIL OF U BOLT FOR RAIL POST

Scale: 3" = 1'-0"

NOTES:

1. The bottom of each railing post shall be thoroughly coated with an aluminum impregnated caulking compound before installation.
2. Railing post to be set normal to parapet.

DES.	—
DR.	
TR.	
CHK.	
APP'D	

Boston Blue Print 300-4-57

AS BUILT - NO REVISION

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

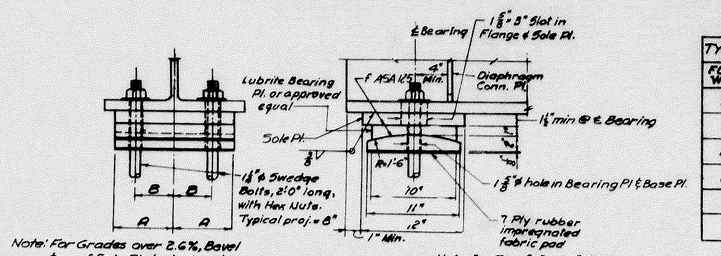
STANDARD RAILING DETAILS

SHEET NO. 27 OF 50	SCALE: AS NOTED	

M-1306 FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS. Gm-14 370

B.P.R. RES. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-3(6)	28	50

FALMOUTH

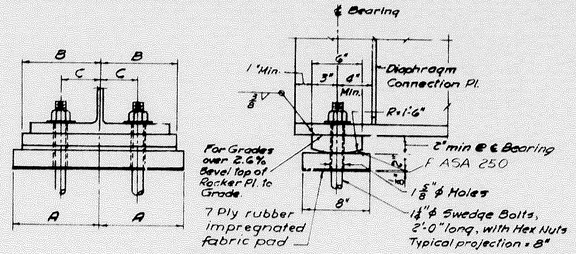


Note: For Grades over 2.6%, Bevel top of Sole Plate to Grade

TYPE A
(EXPANSION BEARING)
Scale: 1½"=1'-0"

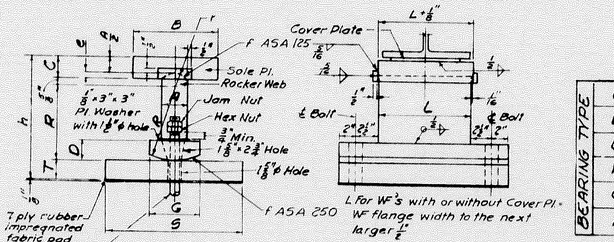
Note for Type "A" and "B" Bearings
All nuts to be drawn up finger tight, then backed off one turn and the threads of the bolts burred off of the face of the nuts with a pointed tool.

TYPE A (EXPANSION)		
FLANGE WIDTH	A	B
16⅛"	7"	4½"
12"	5"	2¾"
11⅛"	5"	2¾"
10⅛"	4½"	2¾"
10"	4⅛"	2¾"
9"	4"	2¾"



TYPE B
(FIXED BEARING)
Scale: 1½"=1'-0"

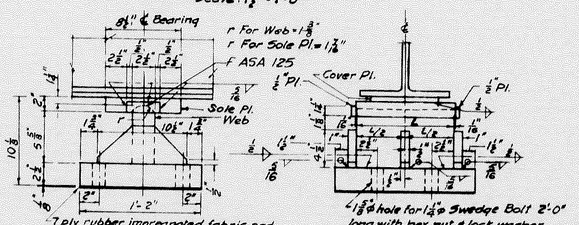
TYPE B (FIXED)			
FLANGE WIDTH	A	B	C
16⅛"	10"	3"	4½"
12"	8"	7"	2¾"
11⅛"	8"	7"	2¾"
10⅛"	7"	6"	2¾"
10"	7"	6"	2⅜"
9"	7"	6"	2¾"



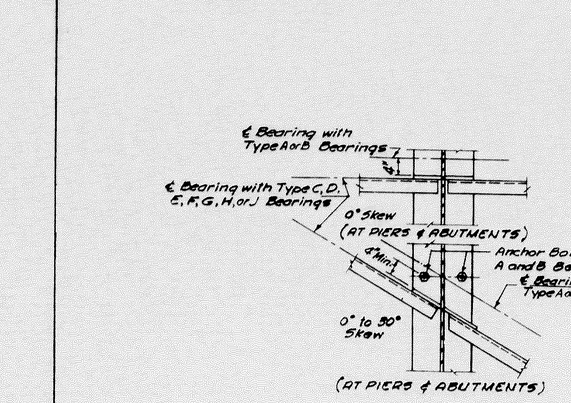
DIMENSIONS										
BEARING TYPE	A	B	C	D	e	G	h	R*	S	T
C	2½"	8½"	2"	2½"	¾"	6"	10⅛"	6"	12"	1½"
D	2½"	8½"	2"	2½"	¾"	6"	11⅜"	7"	14"	1⅝"
E	3"	10"	2½"	2⅝"	1"	6"	13⅜"	8"	14"	2"
F	3"	10"	2⅝"	2½"	1"	6"	14⅝"	9"	16"	2⅛"
G	3⅛"	10"	3"	2⅝"	1⅛"	7"	16⅛"	10"	16"	2⅜"
H	3⅛"	10"	3"	2½"	1¼"	7"	17⅜"	11"	18"	2¾"

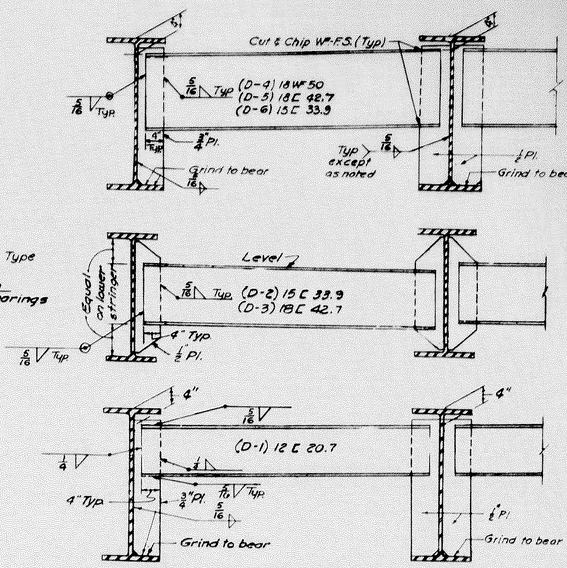
r for Sole Plate = A/2 + 3/16"
r for Rocker Web = A/2 + 1/8"
* R is rocker radius and is concentric with r for rocker web

TYPE C, D, E, F, G, H
(EXPANSION BEARING)
Scale: 1½"=1'-0"

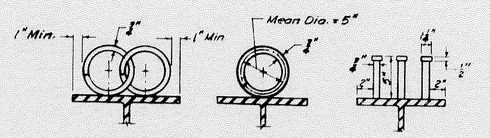


TYPE J
(FIXED BEARING)
Scale: 1½"=1'-0"





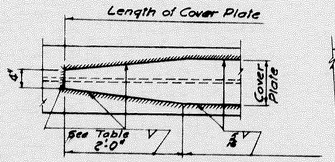
TYPICAL DIAPHRAGM DETAILS
Scale: ⅜"=1'-0"



SHEAR CONNECTOR DETAILS
Scale: 1½"=1'-0"

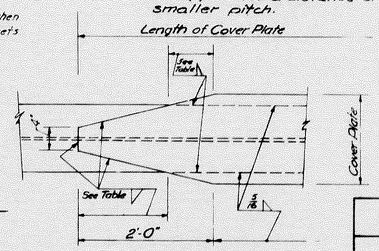
Note: Shear Connectors to be used on bridges when called for on 'Framing Plan and Details' sheets

Spiral Notes
1. All spirals to be fabricated with ⅝"ϕ plain bars and to have a mean diameter of 5 inches.
2. Spirals to be welded to stringer flange with two ⅜" fillet welds, 2¼" long at each point of contact.
3. Spiral lengths given on framing plan are net lengths and do not include any allowance for laps.
4. Where spiral sections are joined, they shall be lapped for a distance of one-half the smaller pitch.



COVER PLATE NARROWER THAN FLANGE

Plate Thickness	Fillet Weld
⅝" to ¾"	¼"
⅞" to 1"	⅜"
1⅛" to 1¼"	½"



COVER PLATE WIDER THAN FLANGE

Plate Thickness	Fillet Weld
½" to ¾"	⅜"
⅞" to 1"	½"
1⅛" to 1¼"	⅝"

TYPICAL COVER PLATE DETAILS

AS BUILT = NO REVISION

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

STANDARD FRAMING DETAILS

SHEET NO. 28 OF 50 | SCALE: AS NOTED

M-1307

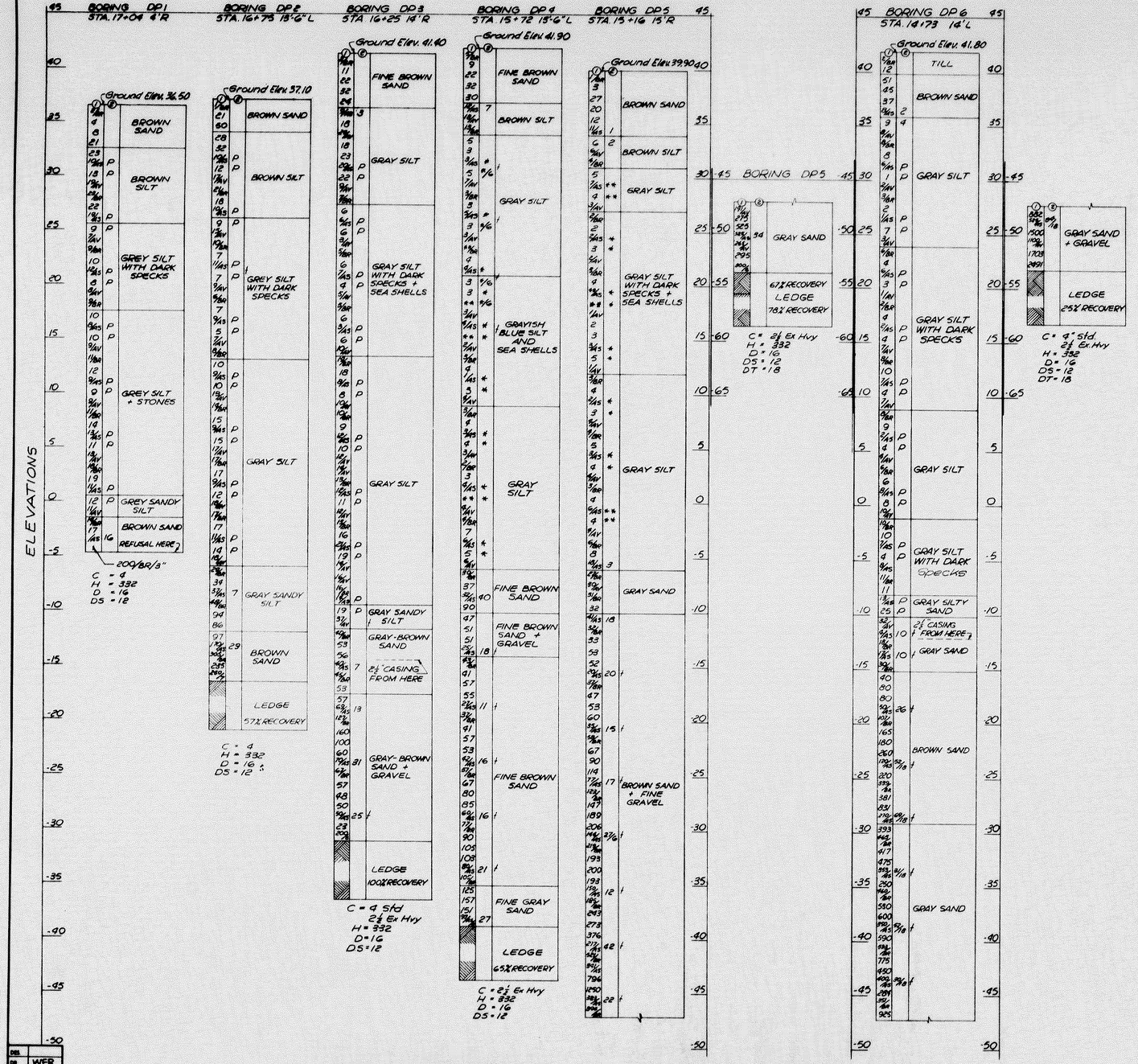
FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.

9m-14
371

DES.	R.W.C.M.Z.
DR.	R.B.
TR.	
CHK.	R.K.
APP'D.	

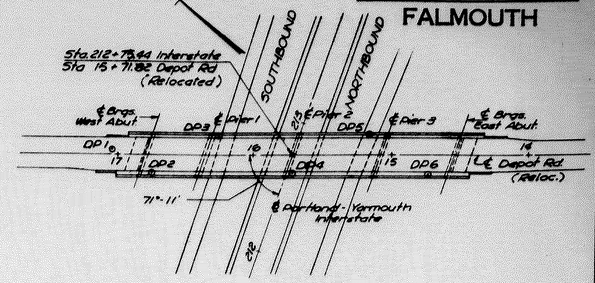
Bruning Blue Print 2000-4-67

0 1 2 3 4 5 INCHES



B.P.R. SEQ. NO.	STATE	FED. AID PROJ. NO.	SHEET NO.	TOTAL SHEETS
1	MAINE	I-295-2(6)	29	50

FALMOUTH



PLAN
Scale: 1" = 50'

GENERAL NOTES

1. BORINGS WERE MADE BY THE MAINE STATE HIGHWAY COMMISSION FEBRUARY & MARCH, 1958
2. FIGURES IN COLUMN ① = BLOWS PER FOOT ON CASING EXCEPT AS NOTED
   FIGURES IN COLUMN ② = BLOWS PER FOOT ON SAMPLER ROD EXCEPT AS NOTED
3. ELEVATIONS ARE REFERRED TO MEAN SEA LEVEL
4. ADDITIONAL SOIL INFORMATION OBTAINED FROM LABORATORY TESTS IS AVAILABLE FROM THE MAINE STATE HIGHWAY COMMISSION

LEGEND

A.S. = CASING WAS DRIVEN AFTER SAMPLING
C. = DIAMETER OF CASING IN INCHES
H. = WEIGHT OF HAMMER IN POUNDS
D. = DROP ON CASING IN INCHES
DS = DROP ON SAMPLER ROD IN INCHES
DT = DROP ON TUBES IN INCHES
B.R. =
A.V. =
+ = WEIGHT OF ROD
+ + = WEIGHT OF HAMMER
P = PISTON
f = FAILED

DES.	
DR.	WFR
TR.	
CHK.	
APP'D.	

Boston Blue Print-300-4-57

STATE HIGHWAY COMMISSION
AUGUSTA, MAINE

PORTLAND-YARMOUTH INTERSTATE

DEPOT ROAD RELOCATED OVER INTERSTATE

BORING DATA

SHEET NO. 29 OF 50 | SCALE: AS NOTED

M-1308 FAY, SPOFFORD & THORNDIKE, INC. ENGINEERS BOSTON, MASS.

Qm-14 372

Appendix F

Bucknam Road Traffic Model Summary

Falmouth - PM Peak Hour

Intersections	Existing		Improved		Lunt One-Lane		Lunt Closed		Lunt Closed, adjusted		Bucknam Closed		Bucknam Closed, adj.		Future		Future+20		Future+20, 3-lane	
	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage	V/C, LOS	Q>Storage
Vehicles Denied Entry	194		0		0		286		96		183		40		0		1		1	
Total Delay	78		84		91		254		208		424		147		80		125		110	
Johnson-Middle	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Johnson-US1	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Long Woods-Middle	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
Falmouth/Bucknam-Middle	OK	EBT50 WBR95 SBL95	OK	EBT50 WBR95 NBR95 SBL95	OK	EBT50 WBR95 NBR95 SBL95	WBT>1	EBT50 EBR95 **WBT50** WBR95 NBT50 NBR95 SBL95 SBT50	OK	EBT50 EBR95 **WBT50** WBR95 NBT50 NBR95 SBL95 SBT50	OK	OK	OK	OK	OK	NBT50 NBR95	OK	EBL95 NBT50 NBR95	OK	NBT50 NBR95
Bucknam-SB ramps	OK	WBT50 SBT50	OK	EBL95 WBT50 SBT50	OK	EBL95 WBT50 SBT50	WBT>1	EBL95 EBT50 WBT50 SBT50	WBT>1	EBL95 EBT50 WBT50 SBT50	OK	OK	OK	OK	OK	WBT50 SBT50	WBT=1 SBT>1	WBT50 SBT50	OK	WBT50 WBR95
Bucknam-NB ramps	SBT>1	SBT>>	OK	OK	OK	OK	OK	EBL95 EBT50 WBT50 WBR95 NBT>> SBT50 SBR95	OK	EBT50 WBT50 WBR95 SBT50 SBR95	SBT>1	NBT>>	OK	SBT50	OK	OK	OK	EBT50 WBT50 WBR95 SBR95	OK	WBT50 WBR95 SBR95
Bucknam-US1	OK	EBL95	OK	EBL95 NBL95 SBT50	OK	EBL95 NBL95 SBT50	EBL>1	EBL95 EBT50 EBR95 **NBL95** NBT50	OK	EBL95 EBT50 EBR95 **NBL95** NBT50	OK	EBT50 **EBR95** WBL95 SBL95 SBT50 SBR95	OK	EBL95 WBL95 SBT50	OK	EBL95	OK	EBL95 NBL95 SBT50 SBR95	OK	SBR95
Lunt-Falmouth	OK	OK	OK	OK	OK	OK	NWL>1	OK	NWL>1	OK	OK	EBT>> WBT>>	OK	OK	OK	OK	NWL>1	NWL95>>	NWL>1	NWL95>>
Lunt-Middle	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	WBT>1	**EBT50** WBT50 NBT50 SBT50	OK	OK	OK	OK	OK	OK	OK	OK
One-Lane Lunt					OK	OK														
Lunt-Depot	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	**EBT>>** WBT>> SBT>>	SBT=1	OK	OK	OK	OK	OK	OK	OK
Depot-US1	OK	OK	OK	EBR95	OK	EBR95	SBL>1	EBR95 NBT50	OK	NBT50	EBT>1 WBT>1 NBL>1 SBT>1	**EBT50** EBR95 NBL95 NBT50 SBL95 **SBT50**	NBL>1 SBT>1	**EBL95** EBT50 NBL95 NBT 50 SBL 95 SBT50	OK	EBR95	OK	EBT50 EBR95 SBT50	OK	EBT50 EBR95 SBT50
Clearwater-US1	OK	OK	OK	OK	OK	OK	OK	EBR95 NBL95 NBT50	OK	NBL95 NBT50	OK	EBR95 NBL95 NBT50	OK	OK	OK	OK	OK	NBT50 SBT50	OK	OK
Hunter-US1	OK	OK	OK	OK	OK	OK	OK	OK	OK	WBT>>	OK	WBT>>	OK	OK	OK	OK	OK	OK	OK	OK

Alternatives

Planned and Programmed Improvements

Long Woods-Middle	in place	in place	in place	in place	in place	in place	in place	in place	in place	in place
Bucknam-NB ramps	in place	in place	in place	in place	in place	in place	in place	in place	in place	in place
Falmouth/Bucknam-Middle							in place	in place	in place	in place

Bold queue indicates spillback to upstream intersection

Temporary treatments: adjust signal timing; install temporary signal; adjust signal timing and lane assignment

Polson, Timothy W.

From: Hanscom, Ed <Ed.Hanscom@maine.gov>
Sent: Friday, January 05, 2018 4:39 PM
To: Kittredge, Joel
Cc: Don, Ratna; Stockin, Adam; Polson, Timothy W.; Gustafson, Garrett A; Folsom, Jeff; Frankhauser Jr, Wayne; Myers, Richard E; Aguilar, Kara A
Subject: RE: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION

Joel,
A long as there are two travel lanes in each direction, closed shoulders would not reduce capacity enough to create a bottleneck on I-295 at Bucknam Rd. However, shortening of the NB decel lane and SB accel lane at Exit 10 could affect operation at these locations. I will ask Kara Aguilar to look at that.

On the one-lane closure of Bucknam Rd bridge, it looks like closing westbound can work if Lunt Rd intersections with Depot Rd, Middle Rd, and Falmouth Rd are signalized and some other signalized intersections are retimed. Closing eastbound will be evaluated next. More details next week. --- Ed

---

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Sent: Friday, January 05, 2018 1:17 PM
To: Hanscom, Ed <Ed.Hanscom@maine.gov>
Cc: Don, Ratna <Ratna.Don@maine.gov>; Stockin, Adam <Adam.Stockin@wsp.com>; Polson, Timothy W. <Timothy.Polson@wsp.com>; Gustafson, Garrett A <Garrett.A.Gustafson@maine.gov>; Folsom, Jeff <Jeff.Folsom@maine.gov>; Frankhauser Jr, Wayne <Wayne.Frankhauser.Jr@maine.gov>; Myers, Richard E <Richard.E.Myers@maine.gov>
Subject: RE: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION
Importance: High

Hi Ed:

As we work toward readying for the meeting and identifying the Bucknam project traffic information referenced below, could you also tell us what the numbers say re windows/effects related to shoulder (not lane) closures on I-295?

Thanks---Joel

-----Original Appointment-----
From: Kittredge, Joel
Sent: Friday, December 29, 2017 2:39 PM
To: 'Polson, Timothy W.'; (Garrett.A.Gustafson@maine.gov); Don, Ratna; Hanscom, Ed; Folsom, Jeff; Frankhauser Jr, Wayne; Myers, Richard E
Cc: Stockin, Adam
Subject: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION
When: Friday, January 12, 2018 12:30 PM-2:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: DOTConfRM, 227A; DOTConfRM, 227B

DISCUSS

- **REPLACEMENT VS WIDENING**
- **LCCA & SERVICE LIFE**

- **TRAFFIC CONTROL, INTERSECTIONS, LOS, ETC.**

DRAFT REPORT AND AGENDA WILL BE FORWARDED IN ADVANCE.

Ed:

It would be very helpful if you are able to forward your material to Adam by later next week.

Thanks---Joel

HAPPY NEW YEAR TO ALL!!!

Polson, Timothy W.

From: Hanscom, Ed <Ed.Hanscom@maine.gov>
Sent: Tuesday, January 09, 2018 10:54 AM
To: Kittredge, Joel
Cc: Stockin, Adam
Subject: RE: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION

Hi, Joel.
Below are my summary tables of delays and user costs for the Bucknam Rd bridge project. In addition to the user costs associated with delay, costs were also estimated for the additional distance traveled by detoured traffic. All three bridge closure options (WB open, EB open, and bridge closed) were compared to the "improved" alternative, which assumes that two programmed intersection projects are in place. Each of the closure options requires some retiming of existing traffic signals and one or more temporary traffic signals to accommodate detoured traffic.
As expected, the full closure of the Bucknam Rd bridge would result in the most delay and highest user costs. The simulation of this alternative showed vehicles denied entry to the model at both the Bucknam @ NB ramps intersection and the US 1 @ Depot intersection. Both one-way closure alternatives had similar total user costs which were about one third of the full closure alternative. --- Ed

Falmouth - PM Peak Hour								
	Alternatives							
Intersections	Existing		Improved		Bucknam WB open only		Bucknam EB o	
	LOS - delay	Q>Storage	LOS - delay	Q>Storage	LOS - delay	Q>Storage	LOS - delay	Q>
Vehicles Denied Entry	194		0		0		1	
Total Delay	78		84		97		86	
Johnson-Middle	OK	OK	OK	OK	OK	OK	OK	OI
Johnson-US1	OK	OK	OK	OK	OK	OK	OK	OI
Long Woods-Middle	OK	OK	OK	OK	OK	OK	OK	OI
Falmouth/Bucknam-Middle	C	EBT50 WBR95 SBL95	D-41.4	EBT50 WBR95 NBR95 SBL95	D-37.4	OK	C-26.9	NE
Bucknam-SB ramps	C	WBT50 SBT50	B-16.9	EBL95 WBT50 SBT50	B-14.2	OK	A-7.1	OI
Bucknam-NB ramps	C	SBT>>	B/C-19.5	OK	C/B-20.5	OK	C-22.0	OI
Bucknam-US1	B	EBL95	C-24.5	EBL95 NBL95 SBT50	B/C-19.3	EBL95	B-17.8	EE
Lunt-Falmouth	A	OK	A-7.8	OK	A-7.5	OK	B-13.8	OI
Lunt-Middle	B/A	OK	B/A-10.6	OK	C/D-34.7	OK	B/C-19.6	W
One-Lane Lunt (not applicable)								
Lunt-Depot	A	OK	A-2.1	OK	A-8.7	OK	B/C-19.9	OI
Depot-US1	C/B	OK	C-21.2	EBR95	C-24.4	EBR50	C/B-20.6	EE NE
Clearwater-US1	A	OK	A-7.4	OK	A-7.8	NBT95	A-7.9	EE
Hunter-US1	A-2.3	OK	A-2.3	OK	A-3.2	OK	A-2.2	OI
Planned and Programmed Improvements								
Long Woods-Middle			in place		in place		in place	
Bucknam-NB ramps			in place		in place		in place	
Falmouth/Bucknam-Middle								
Bold queue indicates spillback to upstream intersection								
LOS - delay based on overall intersection delay and signalized LOS scale								
Temporary treatments					install temporary signal			

Bucknam Road Bridge User Impacts and Costs					
	Improved Falmouth Network	Bucknam Rd Bridge 1 Lane Open Westbound Only	Bucknam Rd Bridge 1 Lane Open Eastbound Only	Buckna Closed Both Di
PM Peak-Hour Travel				
Vehicles Denied Entry	0	0	1	
Delay (VHT)	84	97	86	
Delay Impacts				
Peak-Hour Delay (VHT)	0	13	2	
Daily Delay (VHT)	0	48	7	
Daily User Costs	0	$ 633	$ 97	$ 3,
Mileage Impacts				
Peak-Hour VMT	6332	6693	6863	
Peak-Hour Added VMT	0	361	531	
Daily Added VMT	0	3610	5310	
Daily User Costs	0	$ 1,336	$ 1,965	$ 3,
Combined Daily User Cost		$ 1,969	$ 2,062	$ 6,

From: Kittredge, Joel
Sent: Monday, January 08, 2018 10:04 AM
To: Hanscom, Ed <Ed.Hanscom@maine.gov>
Cc: Stockin, Adam <Adam.Stockin@wsp.com>
Subject: RE: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION

Lol!

From: Hanscom, Ed
Sent: Monday, January 08, 2018 10:03 AM
To: Kittredge, Joel <Joel.C.Kittredge@maine.gov>
Cc: Stockin, Adam <Adam.Stockin@wsp.com>
Subject: RE: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION

Barring illness, injury, work shutdown, or death, the chances are 100%. My goal is to have the requested information by the end of today. --- Ed

From: Kittredge, Joel
Sent: Monday, January 08, 2018 9:36 AM
To: Hanscom, Ed <Ed.Hanscom@maine.gov>
Cc: Stockin, Adam (Adam.Stockin@wsp.com) <Adam.Stockin@wsp.com>
Subject: FW: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION
Importance: High

Ed:

What are the chances of having something by tomorrow late in the day?? If not tomorrow, then when, please.

Thanks---Joel

From: Stockin, Adam [mailto:Adam.Stockin@wsp.com]
Sent: Monday, January 08, 2018 9:28 AM
To: Kittredge, Joel <Joel.C.Kittredge@maine.gov>
Cc: Polson, Timothy W. <Timothy.Polson@wsp.com>

Subject: RE: FALMOUTH---BUCKNAM CONSTRUCTION OPTIONS, TRAFFIC, AND LIFE CYCLE DISCUSSION
Importance: High

Joel,

Thank you for sending this information along.

I wanted to stress that for us to be able to adequately compare alternatives for this Friday's meeting and provide a recommendation, we need the complete information from Ed's team ASAP including:

- EB Closure as discussed below
- LOS information for the effected intersections as was delivered for Lunt Road, for each of the potential alternatives (EB & WB closed)
- User costs associated with each lane closure alternative

Thanks,

Adam

****

Adam M. Stockin, P.E.
Supervising Structural Engineer

Office: 603 263 8879
Mobile: 603 867 5762
Email: adam.stockin@wsp.com
Please note that my email address has changed.

WSP USA
650 Elm Street, 4th Floor,
Manchester, NH 03101

wsp.com

WSP | Parsons Brinckerhoff is now WSP.

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Cc: Don, Ratna <Ratna.Don@maine.gov>; Stockin, Adam <Adam.Stockin@wsp.com>; Polson, Timothy W. <Timothy.Polson@wsp.com>; Gustafson, Garrett A <Garrett.A.Gustafson@maine.gov>; Folsom, Jeff <Jeff.Folsom@maine.gov>; Frankhauser Jr, Wayne <Wayne.Frankhauser.Jr@maine.gov>; Myers, Richard E <Richard.E.Myers@maine.gov>; Aguilar, Kara A <Kara.A.Aguilar@maine.gov>
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- **LCCA & SERVICE LIFE**
- **TRAFFIC CONTROL, INTERSECTIONS, LOS, ETC.**

DRAFT REPORT AND AGENDA WILL BE FORWARDED IN ADVANCE.

Ed:

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Thanks---Joel

HAPPY NEW YEAR TO ALL!!!

Appendix G

Traffic and Accident Data

STATE OF MAINE

FILE: Falmouth

INTERDEPARTMENTAL MEMORANDUM

Date of Request: 5/3/2016 Return: 5/24/2016

Latest Date Needed By 5/6/2016

To: **Ed Hanscom** Dept.: MDOT, Bridge Program

From: **Janet Damren 4-3462** Dept.: Bridge Program

Subject: **Request for Traffic Information** Project Manager: **Joel Kittredge**

TOWN(S): Falmouth P.I.N. **21720.00** Consultant Proj ☐

COUNTY: Cumberland ROUTE: Bucknam Road

LOCATION/ DESCRIPTION: Bucknam Road over I-295 bridge #5830 which carries Bucknam Rd over I-295. Bridge deck replacement and paint.

	Roadway Changes or Relocation (Attach Sketch)	Turning Movement needed (Provide Locations under Comments)	Other Please Describe Under Comments
Please Check Box if Applicable:	☐	☐	☐

Prep By: MAM

	Description of Sections	Sec. 1	Sec. 2	Sec. 3	Sec. 4	Sec. 5
		Bucknam west of I-295 NB ramps				
1	Latest AADT (Year)	14010(2014)				
2	Current **2018** AADT	14010				
3	Future **2028** AADT	15410				
4	Future **2038** AADT	16810				
5	DHV - % of AADT	10%	%	%	%	%
6	Design Hourly Volume	1750				
7	% Heavy Trucks (AADT)	3%	%	%	%	%
8	% Heavy Trucks (DHV)	2%	%	%	%	%
9	Direct.Dist. (DHV)	63%	%	%	%	%
10	18-KIP Equivalent P 2.0	174				
11	18-KIP Equivalent P 2.5	166				

Notes or Remarks: 18-Kip ESALS is based on 20 year life

PLEASE PROVIDE: (1) PIN NUMBER, (2) THE CURRENT & FUTURE YEARS FOR WHICH YOU WANT AADT CALCULATED, AND SEND TO MIKE MORGAN. (A LOCATION MAP IS NO LONGER NEEDED.)
TRAFFIC REQUESTS WILL BE FILLED ON A FIRST COME / SERVE BASIS. PLEASE SEND WHEN PROJECT KICKS OFF!!!!

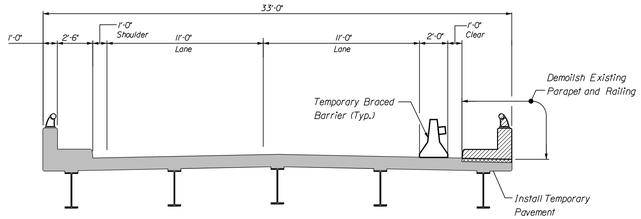
Need Only Data Items Numbered ☐

Comments: Same traffic data as WIN 22672.00 - Section 1.

Appendix J

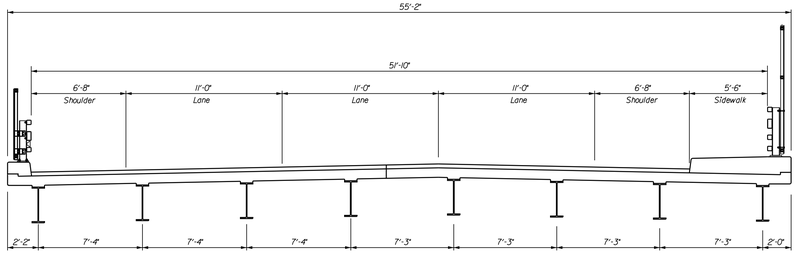
Construction Approach Sketches

(From 1/12/18 Meeting)



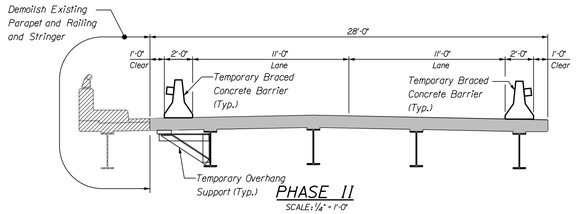
PHASE I

SCALE: 1/4" = 1'-0"



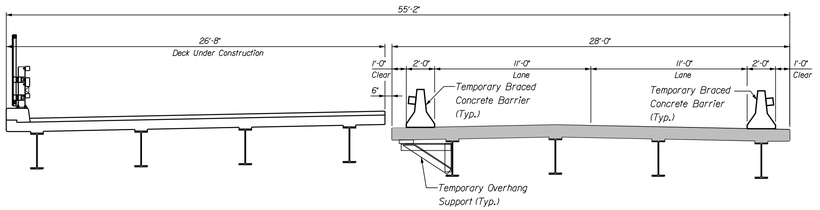
COMPLETED BRIDGE IN SERVICE

SCALE: 1/4" = 1'-0"



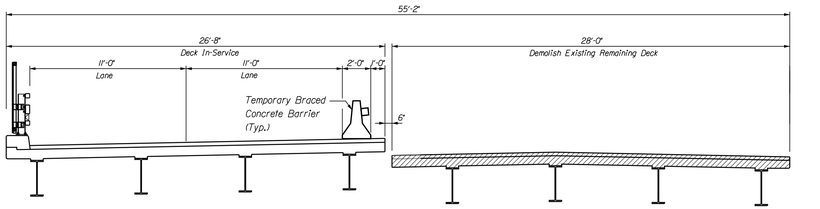
PHASE II

SCALE: 1/4" = 1'-0"



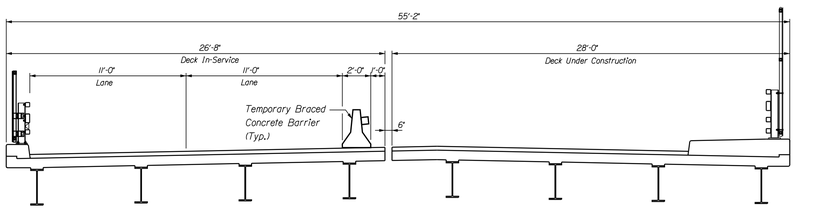
PHASE III

SCALE: 1/4" = 1'-0"



PHASE IV

SCALE: 1/4" = 1'-0"



PHASE V

SCALE: 1/4" = 1'-0"

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

X

PIN
$PINNUMBER$

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER R GAUDREAU		
DESIGN-DETAILED	X	X
CHECKED-REVIEWED	X	X
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1	X	X
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER

DATE

FALMOUTH
BUCKNAM ROAD OVER I-295

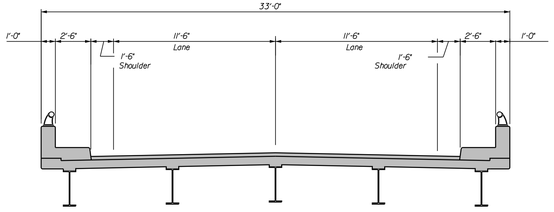
APPENDIX A: BRIDGE WIDENING, TWO LANES

SHEET NUMBER

4

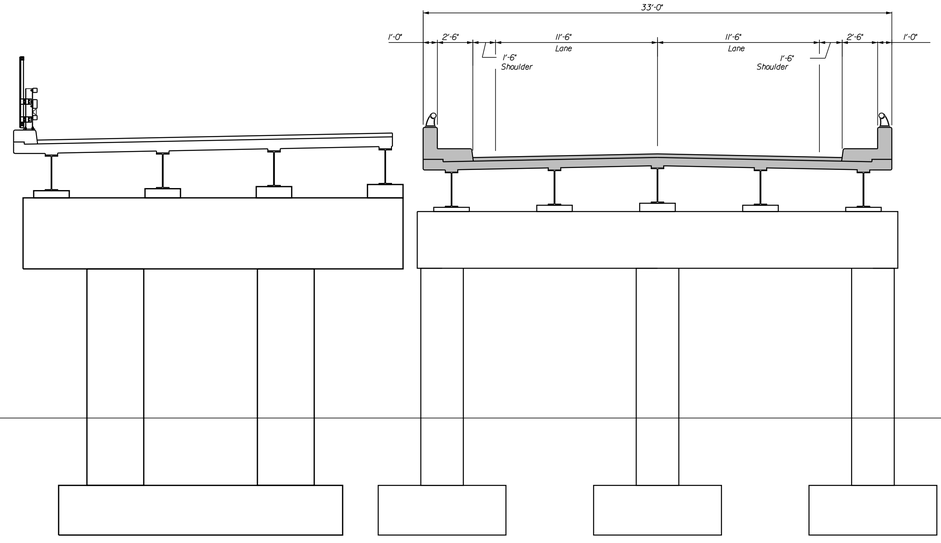
OF 4

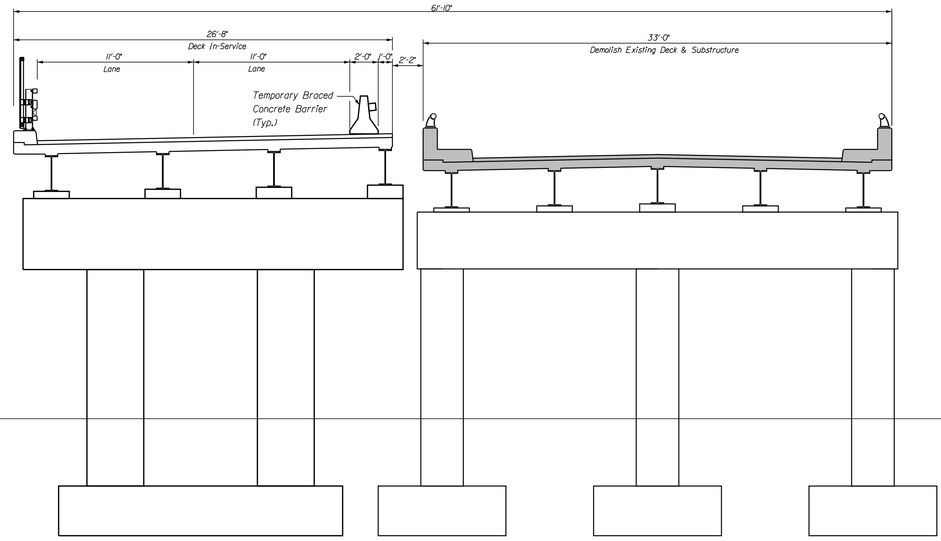
Filename: $file$ Division: $wkgroup$ Username: $user$ Date:$date$

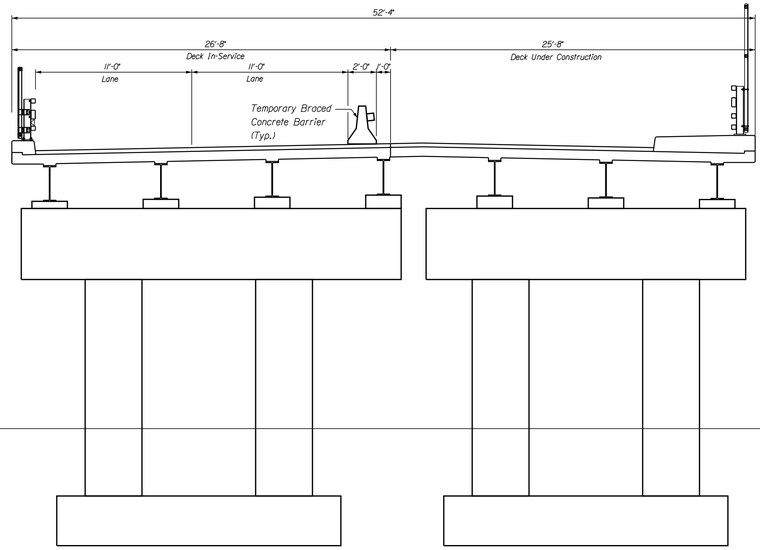


EXISTING BRIDGE SECTION

SCALE: 1/4" = 1'-0"







COMPLETED BRIDGE IN SERVICE

SCALE: 1/4" = 1'-0"

Filename: ...\TWP\TypSect_Stoging_rev1.dgn Division: Username: Date:9/12/2018

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

X

PIN
PIN TR2083.10 BRIDGE PLANS

	BY	DATE
PROJ. MANAGER R GAUDREAU		
DESIGN-DETAILED	X	X
CHECKED-REVIEWED	X	X
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1	X	
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER X

DATE

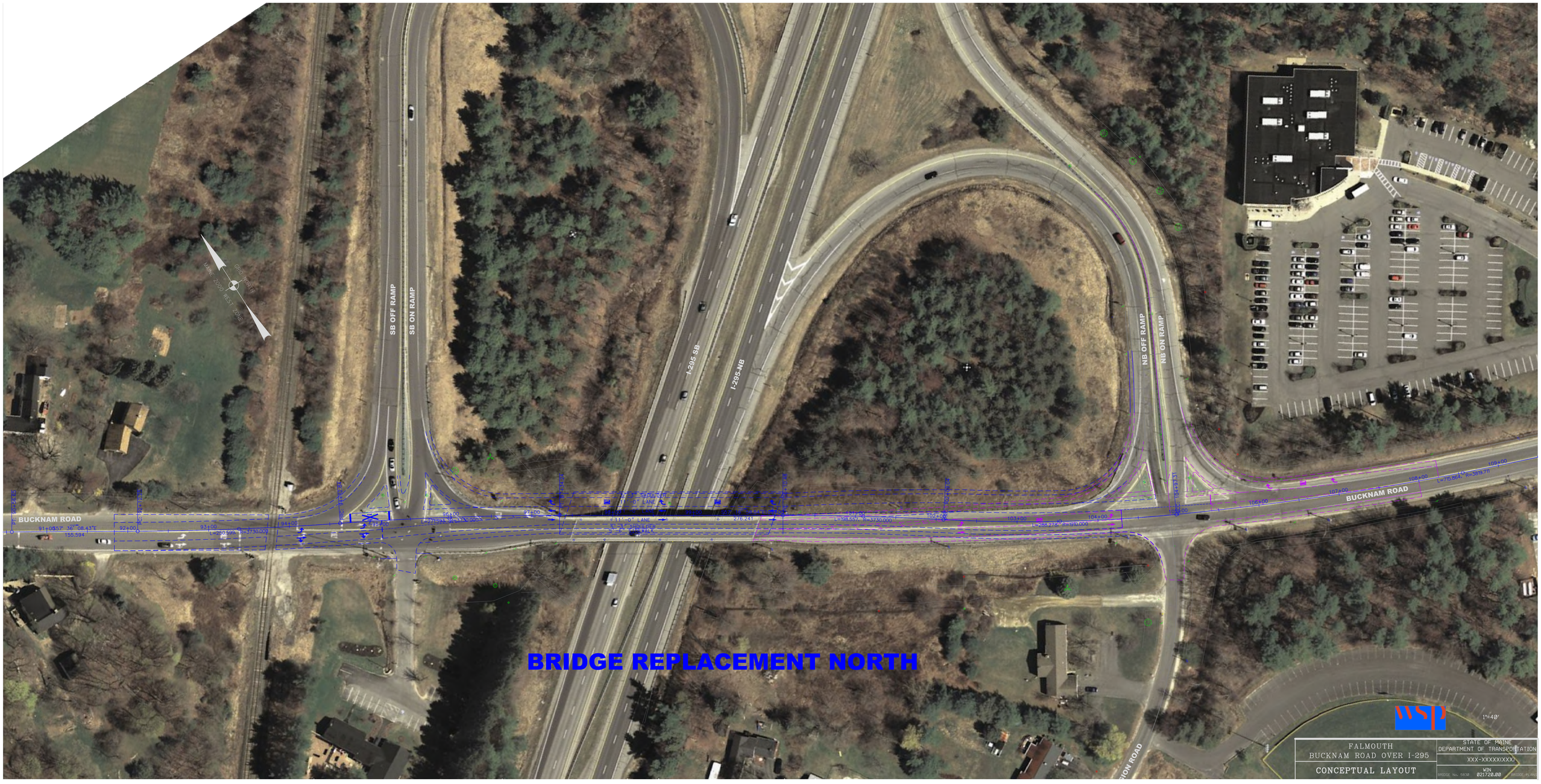
FALMOUTH
BUCKNAM ROAD OVER I-295

APPENDIX C: BRIDGE REPLACEMENT, TWO LANES

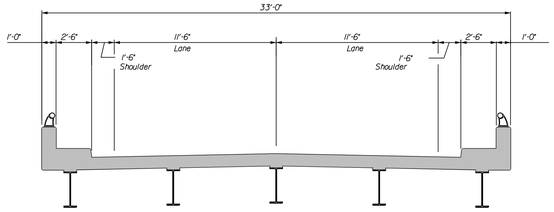
SHEET NUMBER

4

OF 4

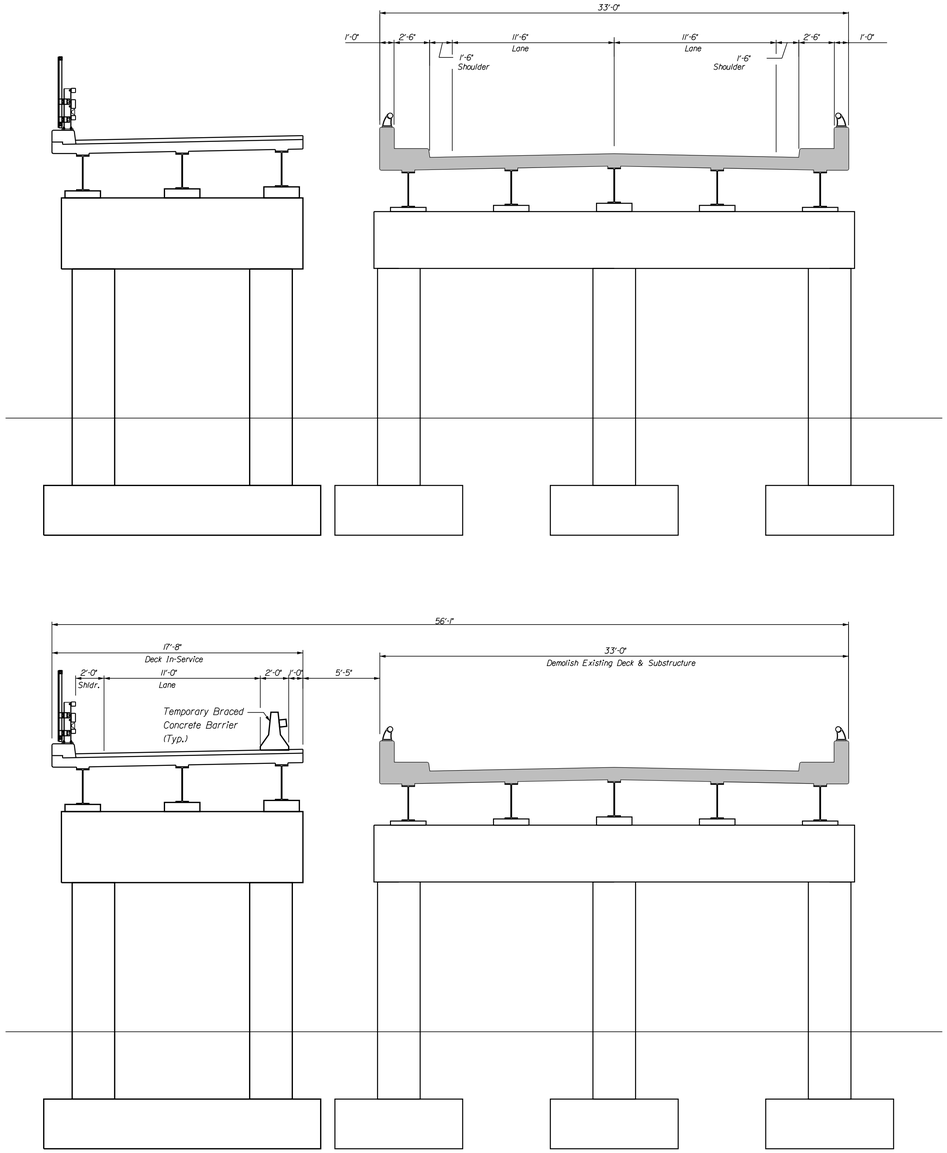


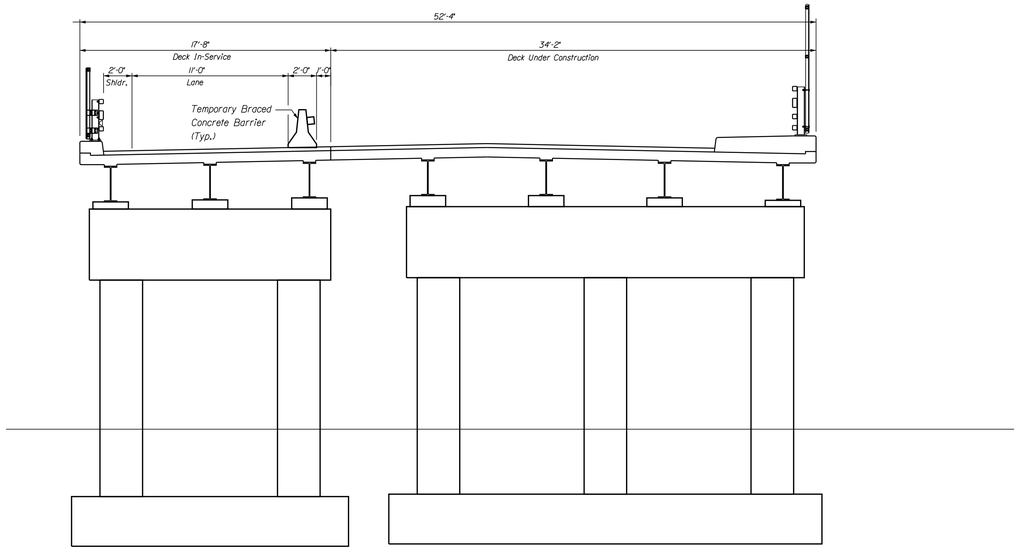
APPENDIX D: BRIDGE REPLACEMENT, TWO LANES

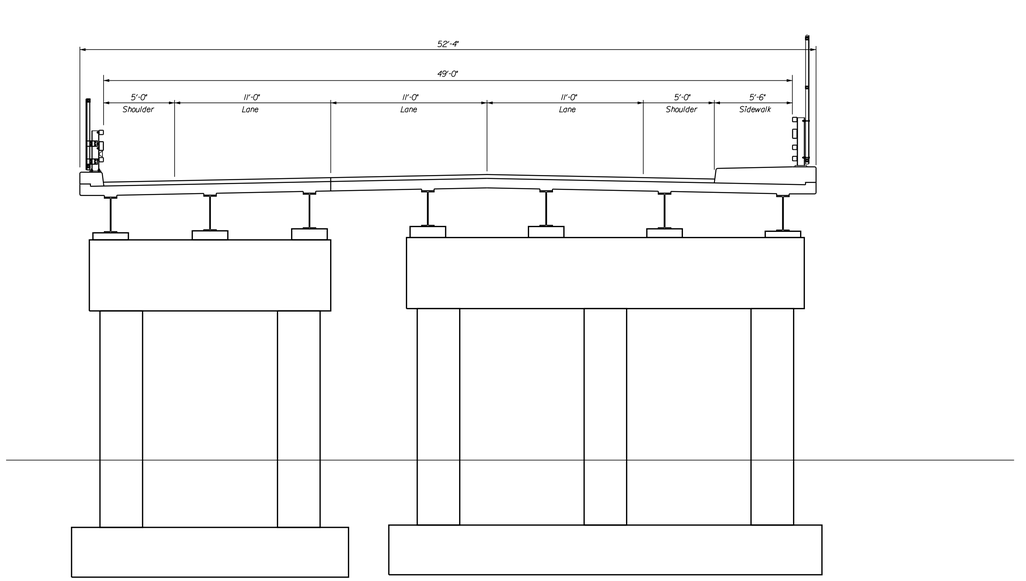


EXISTING BRIDGE SECTION

SCALE: 1/4" = 1'-0"







COMPLETED BRIDGE IN SERVICE

SCALE: 1/4" = 1'-0"

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

X

PIN
$PINNUMBER$

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER R GAUDREAU		
DESIGN-DETAILED	X	X
CHECKED-REVIEWED	X	X
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1	X	
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER X

DATE

FALMOUTH
BUCKNAM ROAD OVER I-295

APPENDIX E: BRIDGE REPLACEMENT, ONE LANE

SHEET NUMBER

4

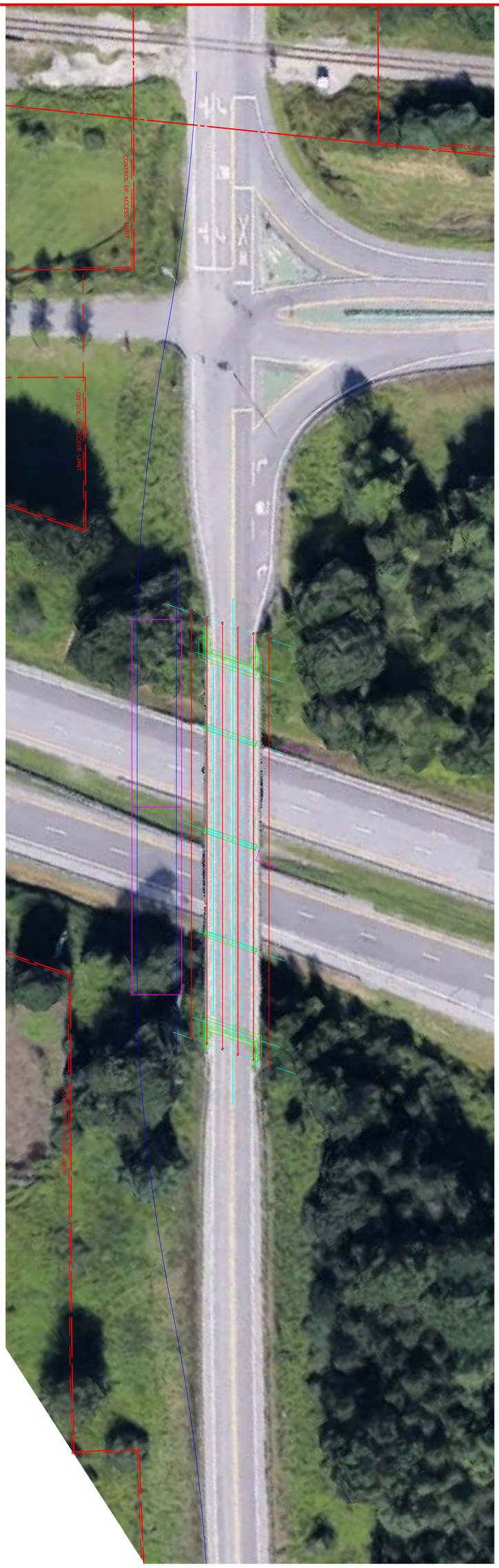
OF 4

Username: $user$ Date:$date$

Division: $wkgroup$

Filename: $file$

Filename: $file$ Division: $wkgroup$ Username: $user$ Date:$date$



SHEET NUMBER 4 OF 4

FALMOUTH
BUCKNAM ROAD OVER I-295

APPENDIX F: BRIDGE REPLACEMENT, TEMP. BRIDGE

		BY	DATE
PROJ. MANAGER R GAUDREAU			
DESIGN-DETAILED	X	X	X
CHECKED-REVIEWED	X	X	X
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1	X		X
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

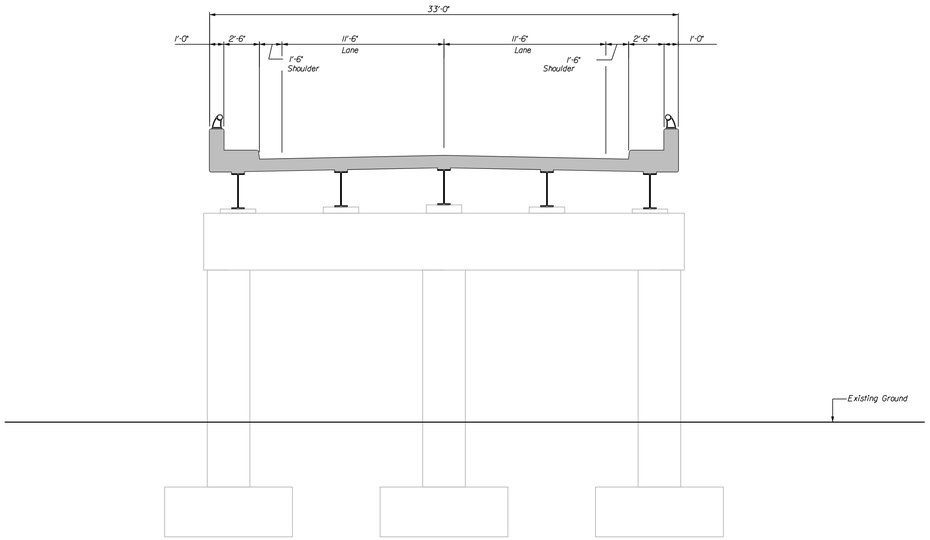
P.E. NUMBER

DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

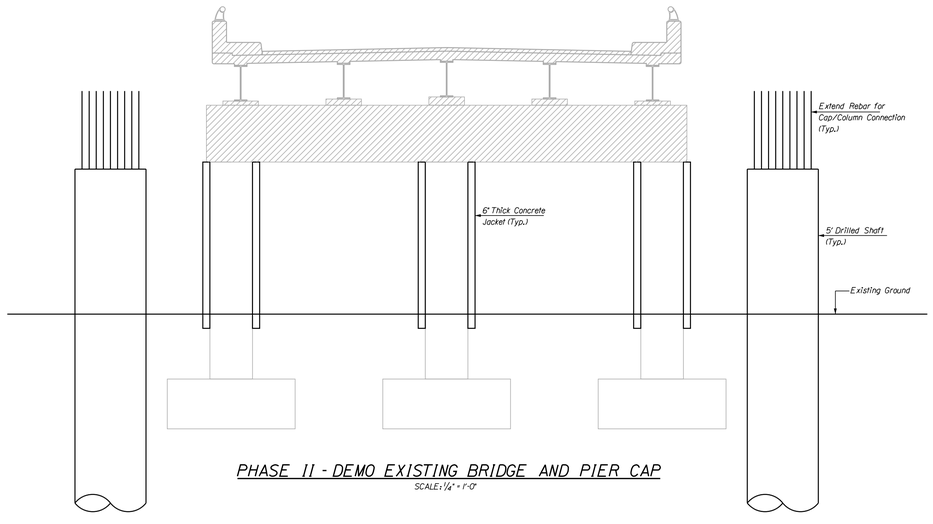
X

PIN
$PINNUMBER$ BRIDGE PLANS



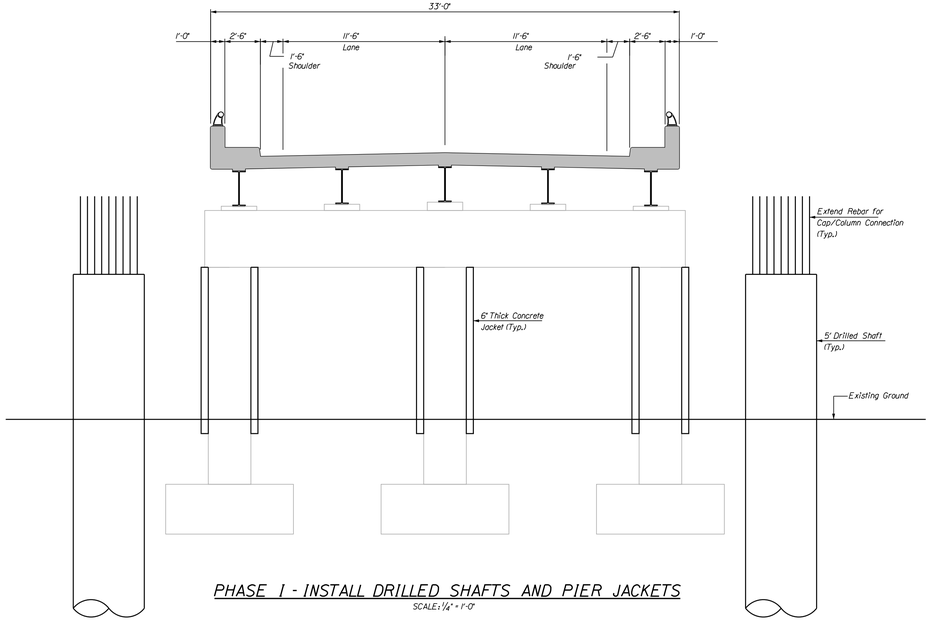
EXISTING BRIDGE SECTION

SCALE: 1/4" = 1'-0"



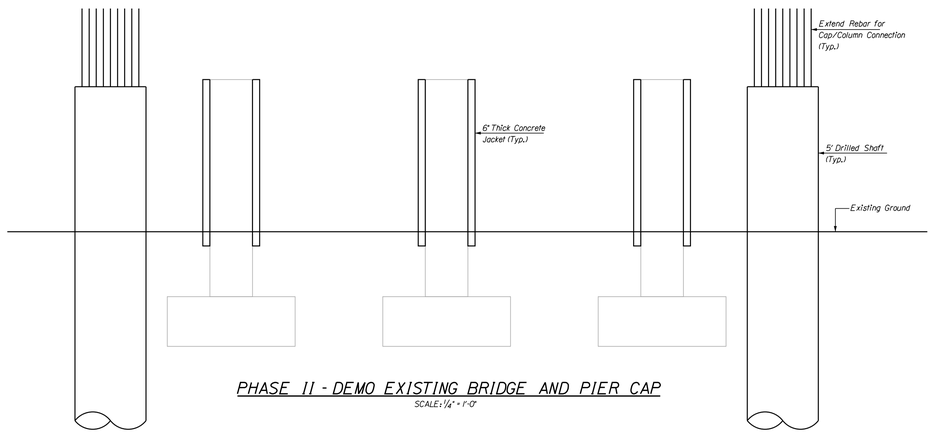
PHASE II - DEMO EXISTING BRIDGE AND PIER CAP

SCALE: 1/4" = 1'-0"



PHASE I - INSTALL DRILLED SHAFTS AND PIER JACKETS

SCALE: 1/4" = 1'-0"



PHASE II - DEMO EXISTING BRIDGE AND PIER CAP

SCALE: 1/4" = 1'-0"

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

X

PIN
$PINNUMBER$

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER	R. GAUDREAU	
DESIGN-DETAILED	X	X
CHECKED-REVIEWED	X	X
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1	X	
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER X

DATE

FALMOUTH
BUCKNAM ROAD OVER I-295

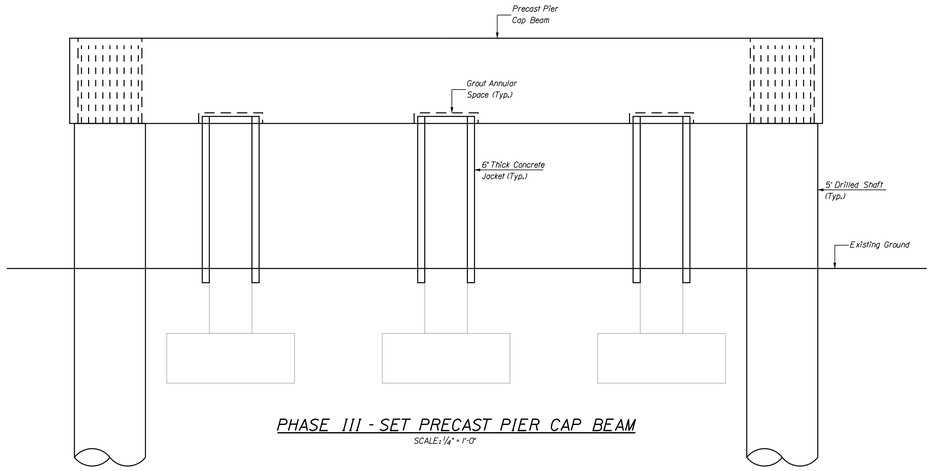
APPENDIX G: BRIDGE REPLACMENT, SLIDE-IN

SHEET NUMBER

4

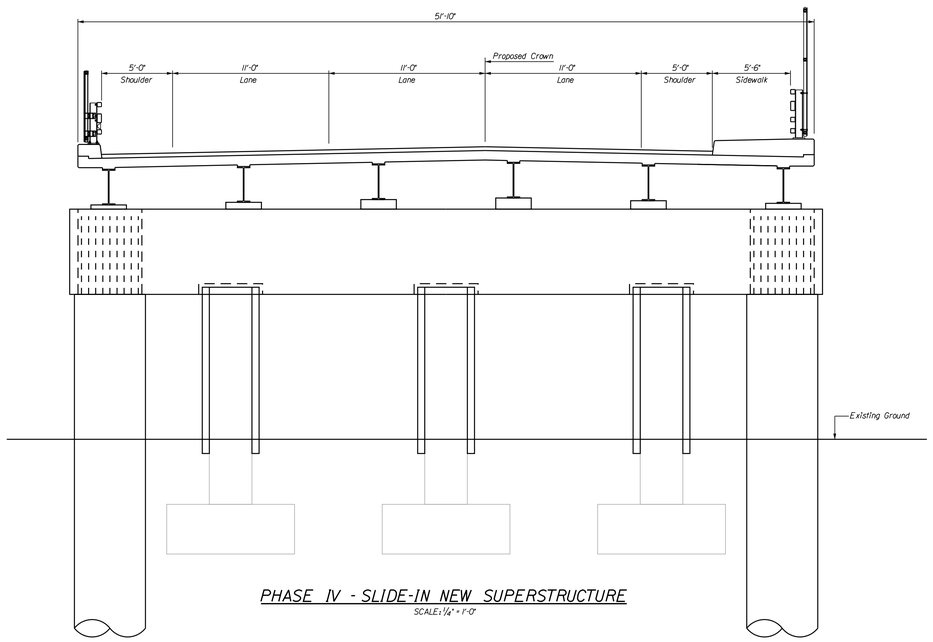
OF 4

Filename: $file$ Division: $wkgroup$ Username: $user$ Date:$date$



PHASE III - SET PRECAST PIER CAP BEAM

SCALE: 1/4" = 1'-0"



PHASE IV - SLIDE-IN NEW SUPERSTRUCTURE

SCALE: 1/4" = 1'-0"

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

X

PIN
$PINNUMBER$

BRIDGE PLANS

	BY	DATE
PROJ. MANAGER R. GAUDREAU		
DESIGN-DETAILED	X	X
CHECKED-REVIEWED	X	X
DESIGN2-DETAILED2		
DESIGN3-DETAILED3		
REVISIONS 1	X	
REVISIONS 2		
REVISIONS 3		
REVISIONS 4		
FIELD CHANGES		

SIGNATURE

P.E. NUMBER X

DATE

FALMOUTH
BUCKNAM ROAD OVER I-295

APPENDIX G: BRIDGE REPLACMENT, SLIDE-IN

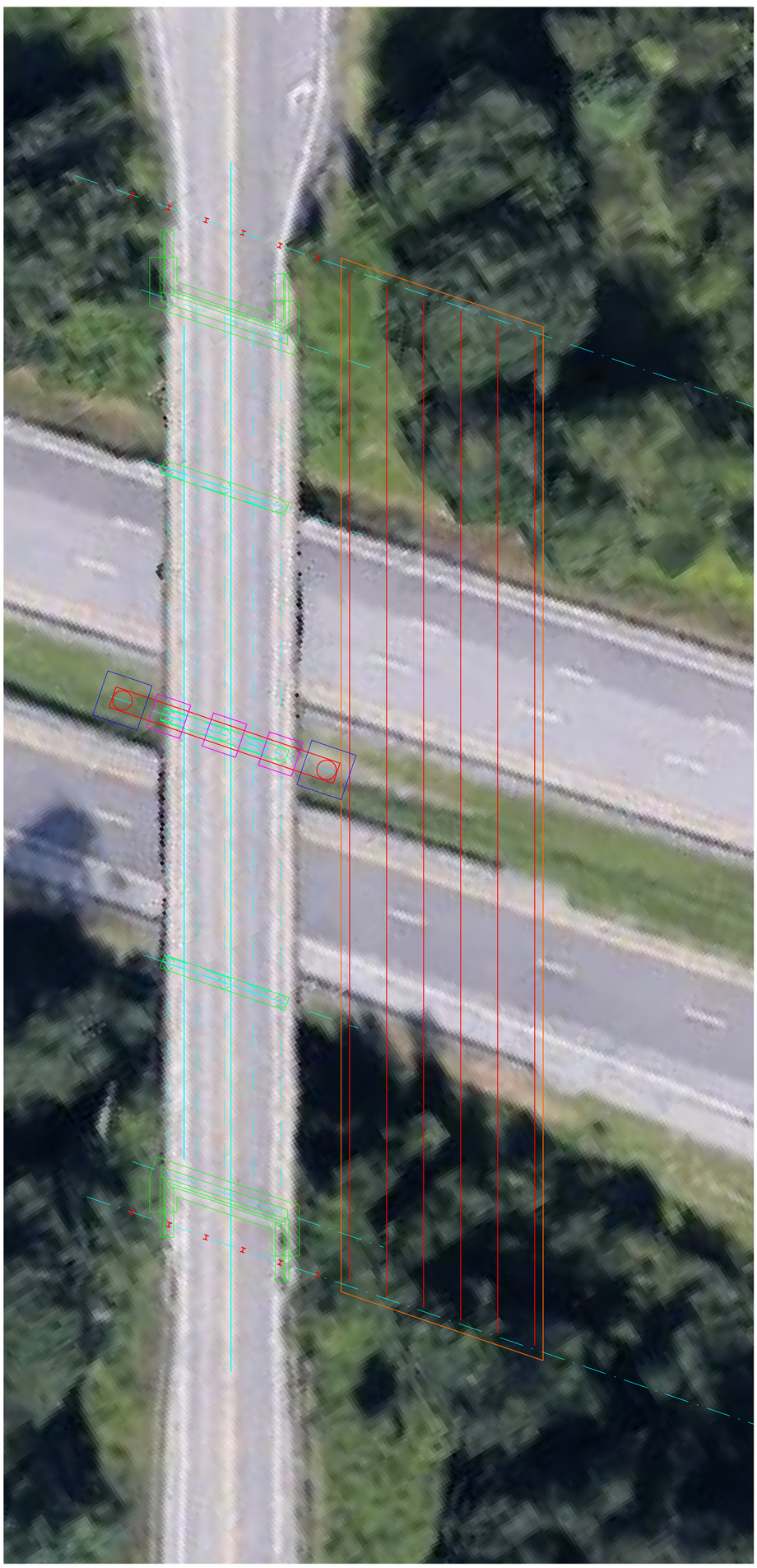
SHEET NUMBER

4

OF 4

Filename: $file$ Division: $wkgroup$ Username: $user$ Date:$date$

Filename: $file$ Division: $wkgroup$ Username: $user$ Date:$date$



SHEET NUMBER 4 OF 4

FALMOUTH
BUCKNAM ROAD OVER I-295

APPENDIX H: BRIDGE REPLACEMENT, SLIDE-IN

		BY	DATE
PROJ. MANAGER	R GAUDREAU		
DESIGN-DETAILED	X	X	X
CHECKED-REVIEWED	X	X	X
DESIGN2-DETAILED2			
DESIGN3-DETAILED3			
REVISIONS 1	X		X
REVISIONS 2			
REVISIONS 3			
REVISIONS 4			
FIELD CHANGES			

SIGNATURE

P.E. NUMBER

DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

X

PIN
$PINNUMBER$ BRIDGE PLANS